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THE IRON TRADE REVIEW

A Weekly Journal Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.

VOLUME XXXVII CLEVELAND, OHIO, DECEMBER 15, 1904 NUMBER 50

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THE IRON TRADE REVIEW

VOLUME XXXVII CLEVELAND, OHIO, DECEMBER 15, 1904 NUMBER 50

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The announcement that the steel rail manufacturers have decided to maintain the $28 price for standard sections for 1905 delivery, while fully anticipated, reinforces the improvement in the iron trade. This price was fixed with the practical assurance that requirements would be in excess of the total for 1903, and with current developments in the billet market indicating a higher price for steel under the natural operation of supply and demand. From the Chicago district comes the report of 100,000 tons of rails closed for next year and of 100,000 tons additional pending. A Southern Railway contract for 75,000 tons of basic rails is also announced, following a recent order from the Louisville& Nashville for 50,000 tons, these two going far toward taking up the rail capacity of the Ensley mill. The Central Western and Eastern rail mills have under negotiation some large tonnages, but sales are not announced. The week has brought the price of light rails closer to the standard section basis, and with re-rolling rails on the present level the competition of re-rolling mills is less in evidence.

All the developments of the week show a further strengthening of the situation at a time ordinarily marked by hesitation. The purchase of 25,000 tons of Bessemer pig iron by the Steel Corporation for December delivery at $15.50 at furnace developed the fact that on one day of the past week the Corporation's pig iron stocks were but 12,000 tons. The one thing preventing the fuller operation of Corporation blast furnaces this month has been lack of coke, and fuel supply is still and promises to continue through the winter, the pivot on which the iron trade will turn. Low water limits coke production and the prospect of car troubles is already taken account of. A sale of furnace coke at $2.25 for the first half of 1905 and the quotation of $2.50 by some Connellsville producers indicate how radical has been the change in fuel cost. The pig iron market, apart from the Bessemer purchase for the Carnegie Steel Co. (which is expected to take 30,000 tons for January delivery), has shown no great activity, but the tendency of prices is upward. Alabama producers generally hold at $13.50 for No. 2 foundry. One has fixed its price at $13.75 and there has been some selling at $13 to retain customers who were turning altogether to Northern iron. Forge iron is scarce in all markets, and $12.75 at Southern and $15.50 at Northern furnace have been reached. Basic iron is in a firm position, demand being apparently in excess of immediate supply. Producers of Bessemer iron now quote $16 at furnace for delivery in the first quarter, with Northern No. 2 foundry at the same figure. Predictions of higher pig iron prices are tempered by the possibilities of imports by foundries on the Atlantic coast. While no sales of British iron are reported, there have been purchases of Cleveland warrants on behalf of Eastern interests, as a safeguard against a further advance in domestic foundry irons. American buying is believed to be responsible in part for the advance in Cleveland warrants, which has caused no little comment in the Middlesbrough district, in view of the laggard price of Cleveland iron bought for actual consumption. The fact that merchant pig iron stocks in the United States were decreased 80,000 tons in November, while production of coke and anthracite iron increased 30,000 tons over October, and is now at a considerably greater rate—with the quiet weeks of the year just ahead—argues for a continuance of firm conditions under anything like the demand expected for 1905.

The current operation of steel works seems only limited by the ability of blast furnaces to furnish iron. The meetings of associations next week will therefore be held under conditions seeming to sustain the advances proposed. Billet and sheet bar manufacturers are now getting premiums of $1.50 and $2 above official prices, but sentiment is not unanimous in favor of a $23 Pittsburg price for billets. Steel bars are scheduled for $1 advance, and plates and structural material are expected to go up in line with the recent advance in steel. Railroad demand for structural steel and the material needed for large buildings projected in Chicago and Baltimore make an unusual quota this week in shapes. There have been several advances in prices within the week—$2 in galvanized sheets, $1 in wire products, $1 in cast iron pipe, in addition to those in light rails and track supplies. Angle bars have been established at 1¼c for next year's contracts.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Dec. 14.

The iron and steel trade in every department continues to show increasing strength, specifications now being received by the producers indicating a greatly increased consumption. Idle plants throughout this district are resuming, and even the foundry industry, especially the plants devoted to the manufacture of car castings report heavy inquiry and the closing of considerable business. That the improvement in the trade is not a spurt such as the market passed through earlier in the year is indicated by the continued activity in practically all lines despite the belief of manufacturers that the heavy buying movement had ended several weeks ago.

On Saturday, Dec. 10, the rail manufacturers after several meetings in New York announced that standard section rails for delivery in 1905 would be sold on the basis of $28 at the mill, this year's price being reaffirmed. That this price would be made was assured as soon as the present improvement in the trade set in. It was also announced that the Lackawanna Steel Co. had become a member of the pool and that its allotment would be 15 percent. An announcement of the rail tonnage already booked for delivery next year by the leading roads of the country is expected this week and conservative estimates place the tonnage already practically booked at several

hundred thousand tons. Light rails have also been advanced from $1 to $1.50 a ton, but present prices are still from $4 to $5 a ton below those prevailing for standard sections. The maintenance of the $28 price on rails means a continuation of the present tariffs on iron and steel products, but the leading steel interests of the country have not been asking lower rates, insisting that with large earnings the railroads will continue to be as large consumers of iron and steel products as in the past.

Despite the fact that the Carnegie Steel Co. has more blast furnaces in operation than at any time since its organization, the United States Steel Corporation was compelled to purchase 25,000 tons of Bessemer from merchant furnace interests to supply the demands of its steel works in this and the Valley districts. This iron is for delivery this month, and the Corporation promises to take 30,000 tons for January delivery. Last week the stocks of pig iron at its various plants amounted to only 12,000 tons, whereas 50,000 tons is none too great a stock.

In finished lines the market continues to show great strength, wire products again advancing $1 a ton on Dec. 9, while advances in other lines are looked for before the first of the year. Heavy contracts have been placed for merchant pipe and tubing for next year's delivery and despite the falling off in demand earlier in the year the increased demand in the last half will result in a greater production this year than last.

Meetings of the billet, plate and beam associations will be held in New York next week, beginning with the meeting of the billet manufacturers on Tuesday, Dec. 20. Billets will in all probability be advanced to $23, while proportionate advances will be made in plates and shapes. A meeting of the steel bar association may also be held. The shafting manufacturers meet in New York on Thursday.

Low water is handicapping all the iron and steel plants on the Monongahela and Ohio rivers. Blast furnaces have been compelled to curtail production on account of the low water while the high sulphur content has resulted in the shutting down of numerous boiler plants. Every effort is being made to keep up production as the furnaces at present are unable to supply enough iron to meet the demands of the steel works.

The sheet and tin plate trades continue to flourish and additional idle mills have been placed in operation this week. The American Sheet & Tin Plate Co. now has only 7 of its 241 tin plate mills idle, 37 idle tin mills having resumed Monday morning. Of the company's 163 sheet mills 136 are in operation, leaving only 27 idle. Of the 111 independent tin plate mills only 28 are now idle.

Coke prices continue to advance. One contract for nearly 80,000 tons of furnace coke for Eastern shipment delivery the first half of the year, having been closed at $2.25. Foundries are also covering requirements for the first half at prices ranging from $2.50 to $2.75, and as high as $3 is asked.

Pig Iron.—This week the Carnegie Steel Co. will blow in its two Donora furnaces and the Ella furnace at West Middlesex will come in before the end of the week. With the two Donora furnaces in operation only 5 of the 51 stacks of the Carnegie Steel Co. will be idle, while only one of the 16 stacks of the Bessemer Pig Iron Association will be out after Ella has resumed. The Republic Iron & Steel Co. and the Jones & Laughlin Steel Co. are operating all their furnaces. Last week the United States Steel Corporation purchased 25,000 tons of Bessemer iron for December delivery at $15.50 at the furnace. During January additional iron will be required, estimated at 30,000 tons. Bessemer iron for delivery the first quarter is now held at $16 and basic for the first quarter at $15.75 to $16, at the furnace. No. 2 foundry is held at $17.35, Pittsburg, and a few furnaces are asking $17.50. Forge iron is held at $15.50 at the furnace and little is to be had at this price. We note the sale of 3,000 tons of Southern forge on the basis of $12.75, Birmingham, while a few operators are asking $13. Southern No. 2 is quoted at $13.50 to $13.75, Birmingham. We revise quotations as follows:

Bessemer, Valley	$15 75 to 16 00
Bessemer, Pittsburg	16 60 to 16 85
No. 1 Foundry	17 75 to 18 00
No. 2 Foundry	17 35 to 17 50
Gray Forge, Pittsburg	16 10 to 16 35
Basic, Valley	15 50 to 15 75
Basic, Pittsburg	16 35 to 16 60

Steel.—Of the eight Bessemer plants of the Carnegie Steel Co. six are in operation and of the two idle plants the one at Mingo Junction will be started in a few days. Not one of the company's open-hearth plants is off, the last idle plant at North Sharon having resumed this week. At the meeting of the billet manufacturers to be held in New York next Tuesday prices will probably be advanced $2 a ton, as this is the price that is now being asked for billets for forward delivery. We make the following quotations: Bessemer and open-hearth billets, 4 x 4 inches, and slabs, up to and including 0.25 carbon, $21, f. o. b. mill, Pittsburg; with actual freight to points of delivery; 0.26 and including 0.60 carbon, $1 advance, 0.61 to 1.00 carbon $2 advance. Billets smaller than 4 x 4 inches $2 advance; sheet and tin bars, $23; cut bars, $23.50; forging billets, $23. Bessemer and open-hearth steel rods are held at $28.50 to $29.

Ferro-Manganese.—The demand for ferro is improving and domestic 80 percent is held at $42.50 to $43, delivered at buyer's mill, east of the Mississippi.

Muck Bar.—Quotations continue to advance, prices being from 50 cents to $1 higher than a week ago. We note the sale of 2,000 tons of neutral bars at $27.85, Pittsburg.

Skelp.—Demand for skelp is strong and prices continue to advance. Grooved steel is held at 1.40c to 1.45c; sheared at 1.50c to 1.55c; grooved iron, at 1.60c to 1.65c, and sheared at 1.70c to 1.75c.

Rails and Track Material.—On Saturday, Dec. 10, the members of the rail pool at a meeting in New York formally decided to hold rails for delivery in 1905 at $28, the price which has been prevailing this year. An announcement is expected this week of a large tonnage of rails placed by the leading roads of the country. It was also decided to hold angle bars at 1¼c, which is somewhat lower than they have been selling heretofore. Light rails have also been advanced in price, but they are still from $4 to $5 a ton below standard sections. Rails standard sections, for delivery next year are quoted as follows: Fifty pounds and over 500 tons, $28; car lots and less than 500 tons, $30; less than car lots, $32; light rails, 16-pounds, $25; 20-pounds, $24; 25 to 45-pounds, $23. Angle bars, 1.25c; spikes, 1.65c to 1.70c.

Bars.—It is probable that a meeting of the steel bar association will be held in New York next week following the meeting of the billet association. Demand for both iron and steel bars is heavy. We quote: Bar iron, 1.55c to 1.59½c Pittsburg; hoops, 1.55c, and bands, 1.30c, both taking bar extras. Bessemer steel bars, 1.30c; open-hearth steel bars, 1.35c; plow and cultivator beams, 1.30c, net; channels, angles, zees and tees, under 3 in., 1.40c. The following differentials are maintained on steel: Less than 2,000 lb. of a size and not less than 1,000 lb., 10 cents advance; less than 1,000 lb. of a size, 30 cents advance.

Plates.—At a meeting of the plate manufacturers to be held next week in New York prices will be advanced in proportion to the advance made in billets. Steel car plants continue to specify heavily and all the mills now have comfortable tonnages on their books. We make the following quotations: Tank plates, ¼ in. thick, 6¼ to 24 in., inclusive, 1.30c f. o. b. mill Pittsburg; over 24 in. up to 100 in., 1.40c. Extras are as follows per pound: Flange

and boiler steel, 10c; marine, A. B. M. A., and ordinary fire box, 20c; still bottom, 30c; locomotive fire box, 50c; plates over 100 in. up to 110 in width, not less than 5c per 100 lb. extra; plates 110 in. to 115 in. wide, not less than 10c extra; 115 to 120 in., 15c extra; plates 120 in. to 125 in. wide, not less than 25c extra; plates, 125 in. to 130 in., not less than 50c extra; plates 130 in. wide, not less than $1 extra; plates 3-16 in. thick $2 extra; gauges 7 and 8, $3 extra; No. 9, $5 extra. Five cents extra for less than carloads. Terms net cash in 30 days, and for all points of delivery in the United States except the Pacific Coast.

Structural Material.—The railroads are inquiring for a large tonnage of structural work to be erected next year and the outlook for the structural mills is unusually bright. The Riter-Conley Mfg. Co. has received the contract for erecting the building for the new plate mill to be built by the La Belle Iron Works amounting to 500 tons, while the Cambria Steel Co. has received an order for 1,500 tons of shapes to be shipped to Australia. The Baltimore & Ohio Railroad will shortly ask for bids for the erection of its new office building in Baltimore which will require about 7,000 tons. A meeting of the beam pool will be held in New York next week when an advance in prices will be made proportionate to the advance in billets. We quote as follows: Beams and channels up to 15 in., 1.40c; over 15 in., 1.50c; angles, 3 x 2 up to 6 x 6, 1.40c; zees, 1.40c; tees, 1.45c; angles, from 3 to 16 in., 1.40c; universal and sheared plates, 6¼ to 24 in., inclusive, 1.30c; over 24 in., 1.40c base.

Pipes and Tubes.—Heavy contracts have been placed by the leading jobbers throughout the country for their requirements next year and the total tonnage placed is several hundred thousand tons. Demand continues heavy and for this season the tube business is in flourishing condition. Discounts to consumers, carload lots, f. o. b. Pittsburg, plus freight to destination according to Tube Rate Book, are as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch	69	53	67	51
⅜ to 6 inches	77	67	75½	65½
⅞ and ½ inch	73	61	71	59
7 to 12 inches	72	57	70½	55
Extra Strong Plain Ends.				
⅛ to ⅜ inch	62	50	60	48
½ to 4 inches	69	57	67	55
4½ to 8 inches	65	53	63	51
Double extra strong plain ends, ½ to 8 inches	58	47	56	45

MERCHANT BOILER TUBES, LESS CARLOADS, 22 FEET AND UNDER.

	Steel.	Iron.
1 to 1½ inches	46	43
1¾ to 2¼ inches	58	43
2½ inches	60	48
2¾ to 5 inches	66	55
6 to 13 inches	58	43

Wire and Wire Nails.—On Friday, Dec. 9, an advance of $1 was made on all wire products. The advance was looked for the first of the month but was delayed. Buying continues heavy and wire and nail plants continue to operate in full. We revise quotations as follows: Wire nails, jobbers' carload lots, $1.75; retailers' carloads, $1.80; and less than carloads, $1.90; painted barb wire, $1.90 to jobbers in carloads; retailers' carloads $1.95, and less than carloads, $2.05, with 30 cents for galvanizing. Annealed smooth fence wire is held at $1.60, with the usual differentials to retailers for carloads and less than carloads. Quotations are all f. o. b. Pittsburg, 60 days, with 2 percent discount for cash in ten days. Iron and cut nails are held at $1.75 and steel $1.70.

Sheets.—Demand for sheets continues heavy and the independent manufacturers are securing their share of the business. The American Sheet & Tin Plate Co. this week has 136 of its 163 mills in operation and before the first of the year practically every mill will be on in full. None of the sheet mills are taking business for delivery next year at present prices anticipating an advance to be made in sheet bars next week. We make the following quotations: Black sheets, one pass, No. 8, 1.75c; No. 9, 1.80c; Nos. 12 to 14, 1.85c; Nos. 15 to 17, 1.90c; Nos. 18 to 21, 1.95c; Nos. 22 to 24, 2c; Nos. 25 to 26, 2.05c; No. 27, 2.10c No. 28, 2.20c; No. 29, 2.50c; No. 30, 2.60c. Galvanized: Nos. 16 to 17, 2.40c; Nos. 18 to 21, 2.45c; Nos. 22 to 24, 2.60c; Nos. 25 to 26, 2.80c; No. 27, 3c; No. 28, 3.30c; No. 29, 3.60c; No. 30, 4c.

Merchant Steel.—Contracts for merchant steel for delivery the first half of the year are now being placed, while the current tonnage is unusually heavy. A meeting of the shafting manufacturers will be held in New York on Thursday, but no change in prices is anticipated. Quotations are made as follows: Cold rolled and ground shafting 52 percent off in carload lots, and 47 off in less than car lots, delivered in base territory; tire steel, 1.50c to 1.55c; open-hearth spring steel 1.90c to 2c; sleigh shoe, flat, 1.45c to 1.50c; smooth finished machinery steel, 1.50c; toe calk, 1.85c to 1.90c.

Old Material.—We note the sale of 5,000 tons of heavy melting stock to one leading local interest at $16. Cast scrap is held on practically the same basis. Prices have been advancing in all lines in sympathy with pig iron, although the sales have not been very heavy. We make the following quotations, gross tons: Heavy melting stocks, $15.75 to $16; cast scrap, $15.50 to $15.75; No. 1 wrought scrap, $16 to $16.25; iron borings, $9.50 to $10; re-rolling rails, $15.75 to $16; sheet scrap, bundled, $12.75 to $13.

Coke.—One leading Eastern interest paid $2.25 for furnace coke for delivery the first half of next year. About 80,000 tons will be required. Another order for about the same amount was turned down at this price and Connellsville operators are now asking $2.50 for furnace coke for first half delivery. Foundry coke is held at $2.50 to $2.75 for first half delivery, although a few operators are asking $3. Of course the water shortage continues to handicap operations, nevertheless the output is close to 300,000 tons in the upper and lower regions weekly, while less than 5,000 ovens are now idle. The fact that so much is being consumed while coke continues scarce indicates the tremendous increase in consumption in the past month. During the week ending Dec. 3, the output of the upper region reached 227,843 tons, while the lower region produced 66,900 tons. Out of a total of 23,178 ovens in the upper region only 4,209 are idle, while the 6,189 ovens in the lower region 5,418 are operating.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Dec. 13.

Official announcement that the price of standard rails for the coming year has been reaffirmed at $28 a ton was made last Saturday and was followed by the placing of contracts through local offices for nearly 100,000 tons of rails for delivery in 1905. The settlement of this much mooted question is expected to be followed by an increased demand for all iron and steel products. Not in two years has the market been in such healthy condition as it is to-day. Inquiries for both crude and finished material are increasing, and the pressing calls from concerns asking that contract shipments be anticipated or rushed through points to depleted stocks and increased demand for the finished product of these consumers. By far the greater number of concerns that have covered for their early 1905 wants have done so on the volume of business transacted in 1904, and there are good indications that there will be a large supplementary demand after the first of the year. More than at any time since the "boom" years of 1901-2, "spot" shipment orders are being received. The heavy fall of snow in the last two

days is expected to increase greatly this class of business, and with consumers clamoring for metal and railroads facing a tie-up in traffic, it will require all the skill of leading producers to prevent a repetition of the experiences of two years ago. Prices in several lines are advancing. The advances recorded in the past week include $2 a ton on galvanized sheets, $1 a ton on wire products, $1 a ton on cast iron pipe, $1 a ton on light rails and an equal amount on track supplies. Billets and sheet bars are very strong, and such as can be obtained are bringing premiums of $1 to $1.50 a ton.

Pig Iron.—From the nature of the buying of the past week, it is inferred that the conviction has been forced home on foundrymen that iron will not sell any cheaper after the first of the year and may be a good deal higher. In the aggregate a fair tonnage has been placed with furnaces in the last seven days, made up in a large measure of supplementary orders from melters who had formerly placed contracts for their supposed requirements for the first three months of the year. The pressing nature of many of these inquiries in their demand for quick shipment is taken to indicate that the melter has at last felt the general improvement in business and is now anxious to add to his depleted stocks. The recent heavy fall of snow is certain to increase the volume of "spot" orders, and while for the time being this class of business can be taken care of without discomfort, a sudden demand of this nature would embarrass furnaces and result in a rise in values. Southern iron is generally held to-day at $13.50 Birmingham for No. 2 foundry. The action of Northern furnaces in holding their product to $16.70, Chicago, for No. 2 foundry keeps Southern producers from marking their prices still higher. As soon as local stacks adopt a higher basis Southern prices will go up. Some Northern interests are already asking $17 for their product, but the bulk of the business is going to the interests quoting below this schedule. Charcoal iron is scarce and is now being quoted in this city at $18. Ohio strong softeners have also been advanced to $19.30 for No. 1. Revised prices representing current quotations are as follows:

Lake Superior Charcoal		to	$18 00
Northern Foundry No. 1	17 00	to	17 50
Northern Foundry No. 2	16 50	to	17 00
Northern Foundry No. 3			16 00
Northern Scotch Foundry			17 50
Ohio Strong Softeners No. 1	19 30	to	19 80
Ohio Strong Softeners No. 2	18 30	to	18 80
Southern Foundry No. 1			17 65
Southern Foundry No. 2			17 15
Southern Foundry No. 3			16 65
Southern Foundry No. 4			16 15
Southern No. 1 Soft			17 65
Southern No. 2 Soft			17 15
Southern Gray Forge			15 90
Southern Mottled			15 90
Southern Silveries (4% to 6% Silicon)	18 15	to	18 65
Jackson Co. Silveries (6% to 8% Silicon)	19 80	to	20 30
Jackson Co. Silveries (8% to 10% Silicon)	20 30	to	20 80
Alabama and Georgia Car Wheel			19 65
Malleable Bessemer			17 00
Basic Iron			17 15

Billets.—The scarcity of Bessemer billets and sheet bars is well exemplified by the experience of a local company who report that business is being offered them by many consumers with whom heretofore they have never had dealings. A number of concerns finding their regular source of supply closed to them are begging other makers to accept their orders and are offering premiums of $1 to $1.50 a ton for early shipments. Wire rods are almost as scarce and the difficulty of placing orders equally great. A sale of 2,000 tons to a Western consumer was made in the last few days on the basis of $30 Pittsburg, but it is doubtful if this price could be duplicated in this market again. Billet prices, while without official change, are very strong. We quote, carload lots, Chicago delivery, as follows: Forging billets, 4 x 4 and larger, up to but not including 10 x 10, $26. Rerolling billets, Bessemer or open-hearth, 4 x 4 and larger up to .25 carbon, $24; up to and including .60 carbon, $1 extra. Billets, 3⅞ in. and smaller, and sheet and tin bars, $26.

Bars.—Railroads and car builders continue the heaviest buyers of bar iron, and the further purchases of cars assure a continuance of the movement in this direction. From other sources than these, mills report a good business, both specifications and new orders coming in freely. Specifications for steel bars are active, the entire output of mills going into immediate consumption. Prices are without change, and we quote carload lots, Chicago delivery, as follows: Bar iron, 1.65c to 1.70c; soft steel bars and bands, 1.46½c base, half extras; soft steel angles, less than 3 x 3, 1.56½c; hoops, 1.71½c, full extras. From store, iron bars are quoted 1.85c to 1.90c base, full extras; soft steel angles, channels and tees, 1.85c to 1.90c half extras; hoops, 2c to 2.10c rates full extras.

Sheets.—Demand for either black or galvanized shows no cessation, and it is becoming increasingly difficult to get quick shipments. An advance of $2 a ton was announced on Dec. 8 in galvanized sheets, making a total advance in this product within a month of $5 a ton. The Inland Steel Co. of this city is getting its sheet mill in shape with a view to starting early in January. We quote revised prices, carload lots, mill shipments, Chicago delivery, as follows: Blue annealed sheets, Nos. 9 and 10, 1.76½c to 1.81½c; Nos. 11 and 12, 1.81½c to 1.86½c; Nos. 13 and 14, 1.86½c to 1.91½c; Nos. 15 and 16, 1.96½c to 2.01½c. On box annealed, one pass, cold rolled, we quote: Nos. 18 and 20, 2.11½c to 2.16½c; Nos. 22 and 24, 2.16½c to 2.21½c; Nos. 25 and 26, 2.21½c to 2.26½c; No. 27, 2.26½c to 2.31½c; No. 28, 2.36½c to 2.41½c; No. 29, 2.46½c to 2.51½c; No. 30, 2.56½c to 2.61½c. Jobbers report an active business and that prices are extremely firm. We quote warehouse prices as follows: No. 10, 1.95c to 2c; No. 12, 2c to 2.05c; No. 14, 2.05c to 2.10c; No. 16, 2.15c to 2.20c; No. 18, 2.30c to 2.35c; No. 20, 2.35c to 2.40c; No. 22, 2.40c to 2.45c; No. 24, 2.45c to 2.50c; No. 26, 2.50c to 2.55c; No. 27, 2.60c to 2.65c; No. 28, 2.70c to 2.75c; No. 29, 2.80c to 2.85c. Galvanized sheets, mill shipments, Chicago delivery, are quoted as follows: Nos. 12-14, 2.46½c; No. 16, 2.61½c; Nos. 18-21, 2.76½c; Nos. 22-24, 2.91½c; No. 26, 3.11½c; No. 27, 3.31½c; No. 28, 3.51½c. Jobbers' prices have been advanced $2 a ton, and we revise our store prices as follows: Nos. 10 to 16 inclusive, 2.80c to 2.90c; Nos. 18 and 20, 2.90c to 3c; Nos. 22 and 24, 3.10c to 3.20c; No. 26, 3.30c to 3.40c; No. 27, 3.50c to 3.60c; No. 28, 3.70c to 3.80c; No. 29, 4.15c to 4.25c; No. 30, 4.60c to 4.70c.

Structural Steel.—Specifications continue in ample proportions and a good tonnage in new business has also been booked. Contracts for one of the local buildings whose construction has been under consideration are pending, and it is expected will be placed this week. The steel required for this building is estimated at 8,000 tons. Store trade is active and prices very firm. We quote mill shipments, Chicago delivery, as follows: Beams and channels, 3 to 15 in. inclusive, 1.56½c; angles, 3 to 6 in., ¼-in. and heavier, 1.56½c; angles, larger than 6 in. on one or both legs, 1.66½c; beams, larger than 15 in., 1.66½c; zees, 3-in. and over, 1.56c; tees, 3-in. and over, 1.61½c, with the usual extras for cutting to exact lengths, punching, coping, bending or other shop work. Store prices on structural materials according to tonnage are 1.85c to 2c for angles, beams, channels, base sizes, with 1.95c to 2.05c for 18, 20 and 24-in. beams; tees and zees, 1.90c to 2c. These prices are for either random lengths or cut to lengths.

Plates.—This product has up to within recent times been one of the weakest on the list. The present demand, however, shows a healthy improvement and is entirely satisfactory to producers. Prices are firm and without

change, as follows: Tank steel, ¼-in. and heavier, 24-in. wide, and under, rectangular plates only, 1.46½c base; over 24-in. to 100-in. wide, 1.56½c base; flange steel, 1.66½c base; marine steel, 1.76½c base, all full extras. Plates, 3-16 in. thick, $2 extra; gauges, 7 to 8, $3 extra; No. 9, $5 extra. Less than carload lots, $5 extra. All the local jobbers have advanced their prices on lots from stock, ranging from $1 to $3 a ton, according to the size of the order and delivery required. We have revised our quotations, and now quote as follows: Tank steel, ¼-in. and heavier, 1.85c to 2c; 3-16, 1.95c to 2.05c; No. 8, 1.95c to 2.05c; flange steel, 2.10c to 2.25c.

Rails and Track Supplies.—The reaffirmation of $28 a ton as the price of standard sections for the coming year has brought the beginning of contracting for this product. The method of equalizing freight rates heretofore in vogue has been done away with, and rails are now quoted $28 f. o. b. mill with freight rate to destination added. Contracts up to date have been closed locally for nearly 100,000 tons for next year's delivery, and an equal if not greater tonnage is in sight or pending. Light rails and track supplies have been advanced from $1 a ton in the week under review, making a total advance in the former within a month of $3 a ton. The demand for both products is very heavy, taxing the capacity of mills to supply. We have revised our prices, and quote heavy sections, in 500-ton lots and over, f. o. b. mill, $28; less than 500 tons to carload lots, $30; less than carload lots, $32. Light rails are as follows: 12 lb. sections, $26; 16 lb., $25; 20 and 25 lb., $24; 30, 35, 40 and 45 lb. sections, $23, all f. o. b. Milwaukee mill. Track supplies, f. o. b. Joliet mill: Angle bars, 1.30c to 1.35c; spikes, first quality, 1.70c to 1.75c; track bolts, 3¼ x ¾, with square nuts, 2.30c to 2.40c per 100 lbs.; with hexagon nuts, 2.45 to 2.55c.

Merchant Steel.—There is little or no change to report in the situation as regards the products listed below. Mills are sold up and practically withdrawn from the market to all except favored customers. Specifications are heavy, the entire output going into immediate consumption. Prices are without change, and we quote mill shipments, Chicago delivery, as follows: Spring steel, 1.85c; sleigh shoe, flat sizes, 1.51½c; concave and convex, 1.60½c to 1.71½c; cutter shoe, 2.25c; smooth finished machinery steel, 1.71½c; smooth finished tire, 1.66½c; plow steel, 2.20c and upwards, according to quality; toe calk steel, 2.01½c; crucible tool steel, 6½c to 8c; special grades of tool steel, 13c and up; cold rolled shafting, 52 percent from list in carload lots, and 47 percent discount in less than carload lots.

Merchant Pipe.—Specifications continue of good volume and sufficient to take care of the current output of mills. Prices are firm, and we quote carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

MERCHANT PIPE.

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	67.35	51.35	65.35	49.35
⅜ and ½ inches	71.35	59.35	69.35	57.35
¾ to 6 inches	75.35	65.35	73.85	63.85
7 to 12 inches	70.35	55.35	68.85	53.35

Boiler Tubes.—Business continues to show improvement. Specifications are heavy and the outlook good Prices are without change, and we quote carload lots, mill shipments, Chicago delivery, as follows:

BOILER TUBES.

	L. W. Steel Percent.	C. C. Iron. Percent.	Seamless Steel. Percent.
1 to 1⅝ inch	44.35	41.35	52.35
1¾ to 2¼ inch	56.35	41.35	40.35
2⅜ inch	58.35	46.35	43.35
2¾ inch to 5 inch	64.35	53.35	Up to 4 inches 50.85
6 to 12 inch	56.35	41.35	

The following are the agreed discounts from store:

	Steel.	Iron.	Seamless Steel.
1 to 1⅜ inches, inclusive	40½	37½	40
1¾ to 2¼ inches, inclusive	50½	36	37½
2½ inches, inclusive	53	37½	40
2¾ to 6 inches, inclusive	60½	47½	47½
6 inches and larger	50½	35	

Cast Iron Pipe.—The inquiries from Deadwood, S. D., and Independence, Ia., noted in our last report, have both been postponed until after the first of the year. Routine business is fair, though the market is generally quiet as the result of the unseasonable weather. Prices have been advanced $1 a ton, and we quote carload lots, Chicago delivery, as follows: 4-in. water pipe, $28.50; 6-in. and larger, $27.50; gas pipe, $1 a ton higher.

Wire Products.—An advance in all wire materials of $1 a ton went into effect last week. The demand has been greatly stimulated thereby, but mills are declining to sell beyond 60 days ahead. The outlook is very good, all the business that can be taken care of being offered. We have revised our prices, and quote carload lots to jobbers, mill shipments, Chicago delivery, as follows: Wire nails, $1.90; painted barb wire, $2.05; galvanized barb wire, $2.35; smooth annealed wire, $1.75; smooth galvanized wire, $2.05; polished staples, $2; galvanized staples $2.30. Less than carload lots to jobbers are 5 cents higher than above prices. The retail trade is quoted 5 cents extra over the foregoing on carload lots, and 10 cents extra on less than carload lots. Bale ties are unchanged at 82½ and 5 percent to 85 percent discount f. o. b. Waukegan, Ill., on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet and DeKalb, with actual freight allowed not exceeding 30 cents per 100 pounds.

Foundry Coke.—The local market is without material change. Plenty of coke is daily on track to more than meet current needs. Prices while holding their own are not any higher. It is expected, however, that the recent heavy fall of snow will delay shipments and create a local scarcity. All dealers are holding strictly to their quotations. Good 72-hour Connellsville foundry coke can be bought from $2.50 to $2.75 at the ovens, and Wise County (Va.) from $2.50 to $2.60 ovens, or $4.75 to $4.85 Chicago.

Old Material.—The market has lost some of its strength since the heavy buying of the past two or three weeks, and prices are slightly weaker. Demand from consumptive sources is falling and no further improvement is looked for until after the first of the year. We have lowered our prices on old iron and steel rails, which are down from 50 cents to $1 a ton. We quote dealers' selling prices as follows:

Old steel rails (4 feet and over)	$15 00 to 16 00
Old steel rails (less than 4 feet)	14 00 to 14 50
Old iron rails	21 00 to 22 00
Relaying rails, subject to inspection	21 50 to 22 50
Relaying rails, subject to inspection	19 00 to 20 00
Old wheels	15 00 to 16 00
Heavy melting steel	13 50 to 14 00
Mixed country steel	9 75 to 10 25
Low phosphorus scrap (.05 and under)	13 50 to 14 00

The following quotations are for net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 2 R. R. wrought	16 00 to 16 50
Shafting	17 00 to 17 50
Dealers' Forge, No. 1	14 00 to 14 50
Wrought pipe and flues	12 50 to 13 00
No. 1 cast, 150 lb. and less	14 00 to 14 50
No. 1 mill	11 00 to 11 50
No. 1 Busheling	12 00 to 12 50
No. 2 Busheling	11 00 to 11 50
Country sheet	8 00 to 8 50
No. 1 boilers, cut	11 50 to 12 00
Boiler punchings	13 00 to 14 00
Iron car axles	21 50 to 22 50
Steel car axles	16 50 to 17 00
Iron axle turnings	11 50 to 12 00
Steel axle turnings	11 50 to 12 00
Cast borings	7 00 to 7 50
Mixed borings, etc.	7 00 to 7 50
Machine shop turnings	11 00 to 11 50
Railroad malleable	12 50 to 13 00
Agricultural malleable	12 50 to 13 00
Stove plate and light cast scrap	12 00 to 12 50
Old iron splice bars	18 00 to 18 50

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Dec. 14.

Iron Ore.—Shipments by lake from Lake Superior mines for the season were 21,226,591 tons, a decrease of only 2,422,959 as compared with 1903. The shortage due to the late opening of navigation has gradually been reduced, it being 6,813,858 tons to Sept. 1 and 5,754,055 tons to Oct. 1. Shipments from Nov. 1 to the close of navigation were the heaviest on record for the time, being 3,569,432 tons, an increase of 2,303,232 over last year. The masters' and pilots' strike was not called off until June 14 and many vessels did not leave port until several days later. A remarkable record was made after July 1, to which date only 1,707,726 tons were moved compared with 8,237,929 tons for the same period in 1903. After July 1, for five months, nearly 4,000,000 tons were moved per month.

The shipments by ports after Nov. 1 were as follows:

	After Nov. 1, 1903.	After Nov. 1, 1904.
Escanaba	364,496	692,335
Gladstone	4,461	*
Marquette	121,467	358,619
Ashland	164,503	386,164
Superior	265,639	687,735
Duluth	173,310	704,560
Two Harbors	172,324	740,019
	1,266,200	3,569,432

The shipments for the season were:

	1903.	1904.
Escanaba	4,277,561	3,644,267
Gladstone	85,816	480
Marquette	2,007,346	1,907,301
Ashland	2,823,119	2,288,400
Superior	3,978,579	4,169,990
Duluth	5,356,473	4,649,611
Two Harbors	5,120,656	4,566,542
	23,649,550	21,226,591

Inquiries for ore for next year's requirements are numerous and show that buyers are anxious to know what prices will prevail. Several hundred thousand tons have been sold at 50 to 60 cents advance over the opening prices of the season just closed, and it is expected that that advance indicates about what the new quotations will be. It is believed that more ore has been forwarded direct to furnaces this year than in any previous year.

Pig Iron.—The market continues very strong and prices in some cases are higher. In Cleveland and the Valley, there is very little iron which can be bought for the next four or five months. Local furnaces have no iron for sale for that period and No. 2 foundry has been shipped from Buffalo at $16.90 delivered or $15.50 at the furnace. That price is lower than can be done in Cleveland or the Valley, in which markets the usual price of $16 and $16.50 has been paid. Sellers are not making any effort to get orders and have all they can do to take care of the business which comes unsolicited. Basic is strong and is so controlled that some sellers have declined to make a quotation of less than $19 for the first quarter and $20 for the second quarter. No sales are reported, however, at those figures. Some Southern interests have sold as low as $13, Birmingham, for No. 2, but $13.50 is the usual price and the largest producer has advanced to $13.75. Even at the high prices prevailing, several thousand tons of Southern has been sold in this locality within ten days. We quote as follows for Cleveland delivery:

Bessemer	$16 00 to 16 85
No. 1 Foundry	16 75 to 17 25
No. 2 Foundry	16 50 to 16 90
No. 3 Foundry	15 75 to 16 00
No. 2 Southern	16 85 to 17 60
Gray Forge	16 10 to 16 35
Gray Forge, Southern	16 00 to 16 60
Lake Superior charcoal	17 00 to 17 50

Coke.—Owing to the snow storm which has been raging in the Pennsylvania coke regions, the delivery has been delayed and prices are tending upward. Quotations are still $2.25 to $2.50 for furnace coke and $2.50 to $2.75 for foundry. Unless the snow melts, which does not seem probable for any time in the near future, prices will be considerably higher.

Finished Material.—Business is brisk in both orders and specifications. The demand for plates is stronger and the improved conditions in other lines are maintained, with the one exception of bar iron. The quotation on bar iron is still 1.55c to 1.60c at the mills, but some plants have so few orders ahead that they may be compelled at any time to close. An advance of the price of steel from 1.39½c, Cleveland, for Bessemer and 1.44½c for open-hearth, would help the rollers of iron and an advance is expected, but for the very reason that it would improve the present very unsatisfactory condition of the bar iron market, the rollers of steel are disposed to be conservative and do not favor a heavy increase in price. There is a strong demand for light rails and 25 lb. sections have been advanced to $23. Owing to increased demand and also to higher prices of spelter, prices of galvanized sheets have been advanced $2 per ton and higher prices of black sheets will probably prevail. The prices of the principal producers through jobbers are as follows: Cleveland delivery, the freight from Pittsburg being 9½ cents: Mill sales of black sheets in car load lots, No. 10, 1.69½c; No. 11-12, 1.74½; No. 14, 1.79½c; No. 16, 1.89½c; No. 27, 2:24½c; No. 28, 2.34½c. Galvanized mill sales: No. 14, 2.49½c; No. 16, 2.59½c; No. 18-20, 2.73½c; No. 22-24, 2.89½c; No. 25, 3.09½c; No. 27, 3.29½c; No. 28, 3.49½c. Out of stock, black sheets ¼ in., 1.70c; 3-16 in., 1.80c. Blue annealed, No. 10, 2c; No. 12, 2.05c; No. 14, 2.10c; No. 16, 2.20c. One pass cold rolled: No. 18-20, 2.35c; No. 22-24, 2.40c; No. 26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 30, 3c. Galvanized out of stock: No. 16, 2.85c; No. 18-20, 2.95c; No. 22-24, 3.10c; No. 26, 3.30c; No. 27, 3.50c; No. 28, 3.70c; No. 30, 3.50c.

Old Material.—There is a lull in the market, but prices are firm. We have not changed quotations except on old car wheels, which have advanced 50 cents. We quote as follows, gross tons, Cleveland:

Old iron rails	$20 00 to 21 00
Old steel rails (over 6 feet)	15 50 to 16 50
Old steel rails (under 6 feet)	15 00 to 16 00
Old car wheels	15 50 to 16 00
Steel boiler plate	10 00 to 11 00
Steel axles	17 00 to 18 00
Malleable iron (railroad)	15 00 to 15 50
Malleable iron (agricultural)	14 50 to 15 00
Heavy steel	15 00 to 15 50

We quote as follows, net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 1 busheling	14 50 to 15 00
No. 1 machine cast	14 50 to 15 00
Iron axles	19 00 to 20 00
Axle turnings	12 50 to 13 00
Wrought turnings (free from cast)	10 50 to 11 00
Grate bars	10 00 to 10 50
Pipes and flues	13 00 to 14 00
Tank iron	10 00 to 10 50
Hoop and band iron	8 00 to 9 00
Sheet iron	6 50 to 7 50
Wrought drillings	10 00 to 11 00
Stove plate	11 00 to 11 50
Cast borings	8 00 to 8 50

CINCINNATI.

Dec. 13

The coke market continues strong with quotations for prompt shipment of furnace coke ranging from $2.35 to $2.50 and on six months' contract from $2.10 to $2.25 per ton f. o. b. ovens. Quotations for foundry coke range from $2.60 to $2.75 f. o. b. Connellsville. It is reported that some of the furnaces in the Birmingham district are seeking temporary coke supplies owing to the uncertainty of labor in the coal mines during the holiday celebrations.

Pig Iron.—The volume of business has been moderate but still quite satisfactory in view of the conditions prevailing. No sales of magnitude are reported and the business was generally well distributed. Only one large inquiry is up. It comes from a large consumer in Pittsburg district and calls for 3,500 tons of gray forge for

December and January delivery. There is an inquiry for 2,000 tons of basic for delivery at a Central Ohio point. Prices have not changed during the week and $13.50 for No. 2 foundry Birmingham and $16 f. o. b. Northern furnace may be regarded as the market. There are exceptions, however, both North and South and a few transactions at $13 Birmingham for No. 2 and an occasional sale at $15.50 in the North is reported. It is noticeable that there is more inquiry for prompt shipment iron and that demand of this character is increasing. Correspondence also indicates that furnace shipments are not coming forward as promptly as consumers would like. Only an occasional sale is being made for delivery in the second quarter of 1905. Trade opinion from the furnace standpoint continues to reflect a firm attitude and sales agents share this view. It seems clear that the market could stand a period of dullness without any weakening effects, as producers are convinced that present prices are justified under all the circumstances. It is intimated that some of the troubles incident to the last boom in prices may again confront the trade. A case in point is that of a certain consumer who placed an order some time ago for 1,000 tons of foundry iron. The furnace taking the order was unable for some reason to fulfill the contract. The order was again placed with another company resulting in a second disappointment. The consumer is now in the market for the third time on the same lot of iron. It is believed in the trade that there will be repetitions of such cases. It is reported that one of the large Central Ohio producers has withdrawn from the market. We quote f. o. b. Cincinnati as follows:

Southern Foundry No. 1	$16 25 to 16 75
Southern Foundry No. 2	15 75 to 16 25
Southern Foundry No. 3	15 25 to 15 75
Southern Foundry No. 4	15 00 to 15 25
Southern Foundry No. 1, soft	16 25 to 16 75
Southern Foundry No. 2, soft	15 75 to 16 25
Gray forge	14 75 to 15 00
Northern Foundry No. 1	17 15 to 17 65
Northern Foundry No. 2	16 65 to 17 15
Southern Charcoal	18 75 to 19 00

Finished Material.—The market continues fairly active with no change in prices. Bar iron continues to lead in the strength but the quotation established a week ago is unchanged. Mill orders are coming forward with reasonable promptness from some districts, but are somewhat slow in other directions. Bar iron is quoted at 1.60c; steel bars at 1.43c, half extras, with dealers quoting 1.75c for iron and steel out of store. Galvanized sheets at 75 and 10 and 5 percent off. We quote black sheets, No. 27, at 2.40c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.70c; No. 27, 2.60c; No. 16, 2.20c; No. 14, 2.10c; No. 12, 2.05c; No. 10, 2c. Tank plates are dull and sell out of store at 1.85c for ¼-in. and 1.95c for 3-16-in. No. 8 and No. 10. Beams and channels are quoted at 1.85c from stock, and angles at 1.85c to 1.90c for base sizes.

In merchant pipe the situation remains unchanged, with demand fairly good but mainly for smaller quantities, so that it is difficult to test competition between independent mills and the leading interest. It is generally believed, however, that prices are fairly well maintained. Car load lots are quoted as follows f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing Discounts.)

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	67.35	51.35	65.35	49.35
⅜ and ½ inches	71.35	59.35	69.35	57.35
¾ to 6 inches	75.35	65.35	73.85	63.85
7 to 12 inches	70.35	55.35	68.85	53.35

Old Material.—There is some slackening in the demand from consumers but the speculative sentiment among the dealers continues to maintain strong prices and quotations are further advanced on most descriptions. We quote f. o. b. Cincinnati:

Old No. 1 railroad wrought, net tons	$15 00 to 15 50
Cast machine and foundry, net tons	13 50 to 14 00
Old iron rails, gross tons	19 00 to 20 00
Old steel rails, gross tons	14 00 to 15 00
Old short lengths, gross tons	14 50 to 15 00
Old iron axles, net tons	19 00 to 20 00
Stove plate, net tons	9 50 to 10 00
Wrought turnings, net tons	10 00 to 10 50
Cast borings, net tons	9 00 to 9 50

PHILADELPHIA.

Dec. 13

Trade is in good condition, but there is no prospect of a great boom and conservative interests are hoping that there will not be any sensational features. The week has been characterized by much inquiry rather than by heavy buying.

Pig Iron.—Prices have advanced to about $17.25 for No. 2 X foundry. Furnaces are well sold up and buyers are pretty well supplied. So no large number of sales are expected soon. The scarcity of coke may prevent an increase in production of iron. Mill irons are hard to get. We quote as follows: No. 1 X foundry, $17.50 to $17.75; No. 2 X foundry, $17 to $17.25; No. 2 X plain, $16.25 to $16.50; gray forge, $15.75 to $16.25; basic, $15.50 to $15.75.

Finished Material.—The demand is not as strong as it was and specifications are rather slow in coming in. Still, prospects are good and there is really little of which to complain in present conditions. We quote: 1.63½c to 1.65c for refined bar iron, and 1.53½c to 1.55c for steel, and 1.43½c to 1.45c for plates, angles and beams and channels.

Old Material.—Prices are firm, but buying might be livelier. We quote: No. 1 steel scrap, $16 to $16.50; low phosphorus scrap, $18 to $18.50; old steel axles, $19 to $19.50; old iron axles, $22 to $22.50; old iron rails, $18.50 to $19; old car wheels, $14.25 to $14.75; choice R. R. No. 1, wrought, $18.50 to $19; machinery scrap, $14.50 to $15; wrought turnings, $12 to $12.50; cast borings, $9.50 to $10; stove plate, $13 to $13.50; wrought iron pipe, $14.50 to $15.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Dec. 13.

Pig Iron.—Although transactions closed during the past week were not as large as for the week previous, prices are firmer. This is especially true of Northern irons, which in some quarters are held at an advance of 25 cents per ton over our last quotations. Northern furnaces are making no effort to get any business for the remainder of the year or for the first quarter, contending that they have sold all the iron they care to for the intervening periods. Northern No. 2 foundry is being strongly held at $16.50 at Eastern Pennsylvania furnaces. In Southern irons there is still little or no business being done in this market. Such sales as have been made, and they are for mixtures, have been at $13.50 Birmingham. All furnaces are being pressed for shipments on old orders, and this is taken to mean that melting is going on more freely than heretofore. The margin of sales at seaboard points between foreign and domestic grades is getting gradually less, but as yet no foreign irons have been purchased. During the past week English brands have advanced 5d, while Scotch irons have shown almost a corresponding decline. The market in general, as compared with last week, shows a falling off in inquiries, due largely to the furnaces discouraging business just now, but the belief that we will probably see higher than lower prices during the next few months has gained many supporters. Closing prices at tidewater follow: Northern No. 1 foundry, $17.50 to $17.75; No. 2 foundry, $17 to $17.25; No. 2 plain, $16.50 to $16.75; No. 1 Southern, $17.50 to $17.75; No. 2 Southern, $17 to $17.25; No. 3 foundry, $16.50 to $16.75; No. 4 foundry, $16 to $16.25.

Rails.—Conferences recently held have resulted in the price for 1905 being fixed at $28 at mill for standard sections. There are reports of considerable bookings, but the only sale

we have been able to confirm is that of 75,000 tons of open-hearth rails by the Tennessee Coal & Iron Co. to the Southern Railway Co. There have been tentative sales made for next year, and they have been variously estimated at from 600,000 to 1,000,000 tons.

Finished Iron and Steel.—Business in structural shapes during the past week was only fair, and was mostly confined to small quantities. The only large sale reported was for 1,500 tons to the Norfolk & Western railroad, and which was taken by the American Bridge Co. The Fort Pitt Co. has been awarded the Boston Elevated contract, which is now estimated at 9,000 tons. The beam association meets next week, and advances are expected. Trade in plates continues very good. The association will convene next week and advance prices. In bars the belief that prices will be raised soon has been responsible for some good sales during the week. The buying in sheets has been mostly for forward delivery, and some good lots have been booked. The advance of $2 in galvanized sheets went in force on Dec. 8. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.54½c; beams, 3 to 15 in., 1.54½c; channels, 3 to 15 in., 1.54½c; beams, 18, 20 and 24 in., 1.64½c; tees, 3 x ¼ in. and heavier, 1.59¼c; plates, carloads, tank, 1.54½c; flange, 1.64½c; marine and ordinary fire box, 1.74½c; refined iron bars, 1.54½c to 1.64½c; soft steel bars, 1.44½c to 1.54½c; sheets, in carload lots, New York, No. 28, black, 2.40c to 2.45c; galvanized, 3.55c to 3.60c.

Old Material.—Prices scored a still further advance during the week, and nearly everything on the list is held at a higher figure than a week ago. While there was more material changed hands during the week than for the week previous, many holders still keep aloof from the market. Heavy steel scrap, old rails, and old car wheels, are most in demand. We quote f. o. b. cars:

Old iron rails	$17 00 to 18 00
Old steel rails, long lengths	15 50 to 16 00
Old steel rails, short pieces	15 00 to 15 50
Relaying rails	20 00 to 21 00
Old car wheels	14 50 to 15 00
Old iron car axles	20 00 to 21 00
Old steel car axles	17 00 to 18 00
Heavy melting steel scrap	15 50 to 16 00
No. 1 railroad wrought scrap	17 00 to 18 00
Iron track scrap	15 00 to 16 00
Wrought pipe	12 00 to 12 50
Ordinary light iron	11 00 to 12 00
Cast borings	7 00 to 8 00
Wrought turnings	9 50 to 10 50
No. 1 machinery cast	12 75 to 13 25
Stove plate	10 50 to 11 50

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Dec. 13.

Pig Tin.—The metal during the past week has been heavy, and further declines have taken place. Interests which have for weeks past been bulling the market are now depressing prices. Consumers are buying very cautiously, and then only to provide for pressing requirements. London during the week has been feverish, and prices for both spot and futures have declined £2. Closing prices today follow: Spot, 28.85c to 29.15c; December, 28.70c to 29.10c; January, 28.60c to 29.00c. London's closings today follow: Spot, £132 10s; futures, £130. Arrivals at Atlantic ports for the month to date aggregate 857 tons, with 2,520 tons afloat.

Copper.—While prices remain unchanged, trade has been reduced to very narrow limits. Buyers are only in the market when necessity requires. The London market during the week has been dull, showing no change. Closing prices for the month to date follow: Lake, 14⅞c to 15⅛c; electrolytic, 14¾c to 15c; casting, 14½c to 14¾c. London closed today: Spot, £66; futures, £66 5s. Exports for the month to date amount to 5,024 tons.

Lead.—Is quiet and unchanged at 4.60c to 4.70c. St. Louis is 4.50c to 4.52½c. London remains at £12 17s 6d.

Spelter.—In fair demand and still quoted at 5¾c to 5⅞c. St. Louis a trifle weaker at 5.70c. London unchanged at £25.

Antimony.—All grades are unchanged. Cookson's is quoted at 9¼c to 9¾c; Hallett's at 9.00c to 9½c, and other brands at 8.00c to 8.50c.

Quicksilver.—We quote $40 per flask of 75 lb. in lots of 100 flasks. London is £7 15s.

Nickel.—Sales are made at 40c to 47c for large lots down to a ton, and at 50c to 60c for small quantities.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Dec. 13.

Demand for metals in this market is of a quiet order. Inquiries are largely for current needs and no interest is shown in future requirements. Prices are firm with the exception of pig tin, which is down ¼ cent. We quote as follows: Lake copper in carloads, 15¼c; in less than carload lots, 15½c to 15¾c; casting copper, 15⅜c for carloads, and 15½c for smaller lots. Pig tin, carloads, 29¾c; lesser quantities, 30¼c. Sheet zinc 6.75c for carload lots of 600 lb. casks, and 7¼c to 7⅝c for less than carload lots. Pig lead, 4.60c for 50-ton lots, 4.75c for carload lots, and 4.90c to 5c for smaller quantities. Spelter, 5¾c for carload lots, and 6c for lesser amounts.

Old metals have weakened in sentiment in sympathy with scrap iron, though as yet no material change in prices is noted. We quote prices paid by dealers as follows: Copper wire and heavy, 12¾c; copper bottoms, 11½c; copper clips, 12¼c; red brass, 11½c; red brass borings, 19½c; yellow brass, heavy, 8½c; yellow brass borings, 7¾c; light brass, 6½c; tea lead, 4⅛c; zinc, 4c.

The Canadian Iron Trade.

TORONTO, Can., Dec. 13.—Frederic Nicholls, vice president of the Dominion Iron & Steel Co., returned last week to Toronto from a trip of inspection to the company's works at Sydney, N. S., which he made in company with President J. H. Plummer. Mr. Nicholls stated that the operation of the coal washing plant recently installed had been highly successful, effecting a considerable economy and an improvement in the quality of the output. The pig iron yield has been considerably augmented. Owing to the extensive orders received for rods, the company expects shortly to operate the rod mill day and night. He anticipated that the steel rail mill would be in operation in about three months. A plate mill is to be installed, most of the machinery for which has already been received. The quantity of iron ore brought to Sydney by the company during the navigation season included 222,050 tons from its own mines at Wabana, Newfoundland, 25,000 tons from Carthagena, Spain, 24,650 tons from Sweden and 18,936 tons from Lake Superior mines—in all 290,686 tons. A meeting of the executive board of the company was held at Montreal Dec. 7 at which satisfaction was expressed with the progress recently made.

A number of Toronto and other capitalists have formed a syndicate for the development of the Atikokan iron range in Northwestern Ontario. James Hunter, mining promoter, and D. Mann, vice president of the Canadian Northern railway, who are largely interested, have gone to Winnipeg to complete negotiations. A blast furnace is under consideration, to be built on the Neebing River between Port Arthur and Fort Williams and a spur line is projected to run from the Canadian Northern to the iron range.

The plant of the Imperial Steel & Wire Co., at Collingwood, Ont., after thorough tests has been put in operation. It is a complete wire plant, with everything of the most modern type, and has a daily capacity of 50 tons. The company has booked sufficient orders ahead to keep the works in operation until the spring.

The Bursting of Four-Foot Fly-Wheels.*

BY CHARLES H. BENJAMIN.

Experiments made hitherto by the writer and described in former papers have been confined to the testing of wheels, whose diameters were 2 ft. and less. The first wheels experimented upon were only 15 in. in diameter and could be regarded as models, nothing more. Enough was learned from these tests to make further investigation desirable, and in succeeding years wheels 24 in. in diameter, of various types of construction and of various materials, cast iron, steel and wood, were tested to destruction. The interest taken in these experiments seemed to warrant carrying them further on a larger scale, such as would correspond with sizes actually in use. Four feet was selected as a limiting diameter and a cylindrical steel casing was built having an internal diameter of 5 ft. Fig. 1 shows the interior and in part the exterior appearance of the casing when completed. The rim or shell was made of steel 1¼ in. thick, having a tensile strength of about 65,000 lb. per sq. in. The upper and lower halves of the rim were flanged at the junction and bolted together by 1-in. steel bolts. The sides were of steel ⅜ in. thick, dowled to the rim and secured by

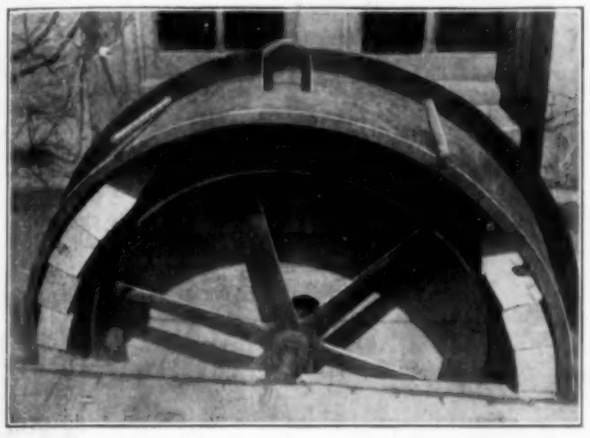

FIG. 1.—CASTING OPEN WITH WHEEL NO. 1 IN POSITION.

through bolts outside and inside the rim as may be seen from the illustrations.

It was not deemed safe to conduct these experiments inside a building, and subsequent developments proved that it would not have been safe, for the building at least. The casing was therefore located just outside the building where the tests were to be made, in a pit or excavation lined with brick. The flanges of the lower half rested on brick piers and were bolted in place. The entire upper half of the casing could be hoisted up, giving access to the interior for setting or removing the wheels. The shaft carrying the wheel to be tested turned in bearings bolted to angle irons on the lower halves of the side plates, and was connected to the driving mechanism just inside the building by a flexible sleeve coupling. After the wheel was in place the casing was lined with wooden blocks to absorb the momentum of the flying fragments, as illustrated in Fig. 1. Instead of using a steam turbine as in former experiments, the flywheel shaft was speeded up by means of a Reeves variable speed counter-shaft, interposed between the line shaft and the driving shaft.

The first wheel to be experimented on was a well-proportioned cast iron pulley, such as is used on shafting for transmitting power. This pulley No. 1 is shown in position inside the casing in Fig. 1. It was 48 in. in diameter, had six arms and weighed 194 lb. The rim was whole and was 8½ in. wide and about ⅜ in. thick, finished on the outside. The arms were elliptical in section, 3¼ in. by 1 1-16 in. at the hub, and 2 in. by ¾ in. at the rim. On the whole the wheel was well designed and showed

FIG. 2.—FRAGMENTS OF WHEEL NO. 1.

no signs of shrinkage strains. It had, however, been balanced in the customary manner by riveting a cast iron washer inside the rim at the lighter side, and this proved its undoing. (See Fig. 2.) The combination of a thin place in the rim, a rivet hole and a heavy mass of cast iron, is enough to wreck any wheel. As shown in the cut it was necessary to still further weight this side by winding lead wire around the arm just inside the rim. As has been shown by previous experiments on whole rim wheels of cast iron, a bursting speed of 400 feet per second may be reasonably expected.

The circumference of a 4-ft. wheel being about 12½ ft., such a wheel should burst at about 32 revolutions per second, or 1,920 revolutions per minute. The pulley in question burst at 1,100 revolutions per minute, as recorded by a tachometer connected to the driving shaft. The appearance of the wheel after breaking is shown in Fig. 2. The balance weight weighed 3½ lb., and its center was approximately 23 in. from the axis of rotation. At 1,100 revolutions per minute the centrifugal force of the balance weight alone would be 2,760 lb. Add this radial pressure at a weak point between the arms to that due to the weight of the rim itself, and the low bursting speed is easily accounted for.

The linear speed of the rim at rupture was 230 ft. per second. As 100 ft. per second is considered the limit for belt speed, this pulley would have a working factor of safety

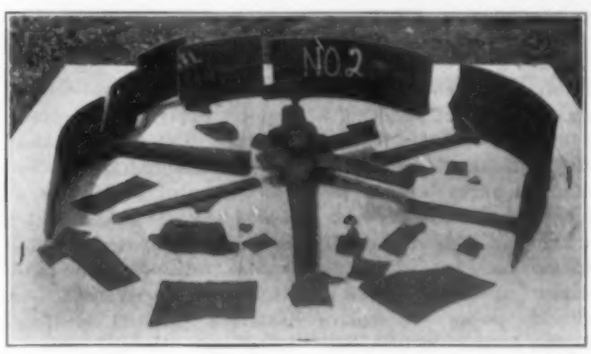

FIG. 3.—WHEEL NO. 2 AFTER BREAKING.

of 2.3x2.3 or 5.3. But suppose the rim had been a little thinner and consequently a bigger weight had been put on with a larger rivet?

Wheel No. 2 is shown after rupture in Fig. 3. It was a cast iron pulley of the same general style and dimensions as No. 1, but with a split hub and rim. The balance weight was

*Read at the New York meeting (December, 1904) of the American Society of Mechanical Engineers.

present here as in the former case, but was obliged to yield the palm to its rival, the flanged joint. The wheel had been cast in one piece, as is usual in such cases, with cavities cored at the joints of rim and hub. After finishing it had been broken apart by wedges, making a fracture joint. The flanges, being located midway between the arms and bolted at some little distance inside the rim, were in the worst

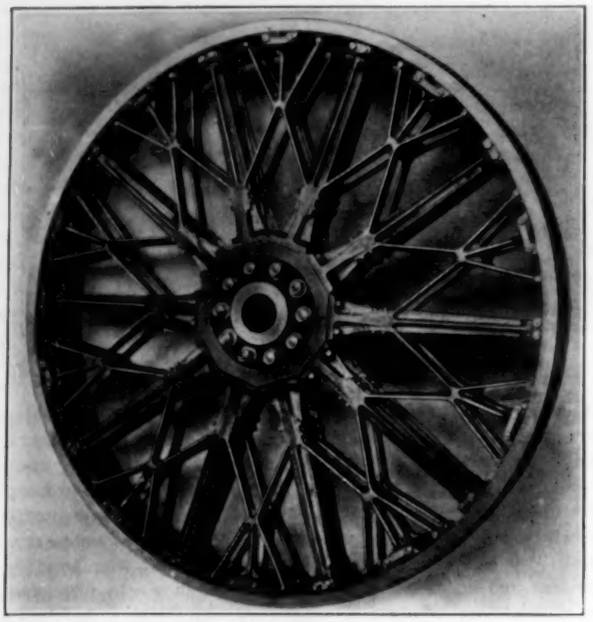

FIG. 4.—WHEEL NO. 3 BEFORE TESTING.

possible position to withstand the bending action due to centrifugal force, and their own weight only aggravated the difficulty.

The flanges shown in the foreground of the illustration weighed with their bolts 7½ lb. This wheel burst at less than 700 revolutions per minute, the tachometer not recording below this speed. The writer believes the speed to have been about 600 revolutions per minute. At this speed the centrifugal force of the flanges on one side would have been 1,680 lb. At 600 revolutions per minute the linear speed of rim would be only 125 ft. per second. At the very common belt speed of 4,500 ft. per minute the factor of safety would be but 2.8, which is altogether too low, considering the nature of the material and the shocks to which a pulley may be exposed. There is one instance on record of the wrecking of an engine by the breaking of a generator pulley, which had a heavy balance weight inside the rim.

It was reserved for wheel No. 3 to develop the most dramatic series of incidents of any yet experimented upon, big or little. Fig. 4 is from a photograph of this wheel taken just before setting in the case. It measured 49 in. in external diameter and weighed about 900 lb. The rim was 6¾ in. wide and 1⅛ in. thick, and was built of ten segments, the material being cast steel. Each joint was secured by three prisoners of an I section on the outside face, by link prisoners on each edge, and by a dovetailed bronze clamp on the inside, fitting over lugs on the rim. The arms were of phosphor bronze, 20 in number, 10 on each side and were a cross in section. These arms came midway between the rim joints and were bolted to plane faces on the polygonal hub. As shown in the cut the rim was further reinforced by a system of diagonal bracing, each section of the rim being supported at five points on each side, in such a way as to relieve it almost entirely from bending. The braces like the arms were of phosphor bronze, and all bolts and connecting links of steel. The wheel was designed by a Baltimore firm as a model of a proposed 30-ft. flywheel.

On account of the excessive air resistance it was found necessary to enclose the wheel at the sides between sheet metal discs, before any great speed could be attained. Even then repeated trials failed to reach a speed of more than 800 or 900 revolutions per minute on account of the great inertia of the wheel, and the consequent slipping of belts. By putting on more and wider belts, by a liberal use of cling-surface and with the aid of a 7½-h. p. electric motor belted on in parallel, it was found possible to get a speed of 1,650 revolutions per minute. After the wheel had been run at this speed it was stopped and examined. The inspection showed fracture of several of the I-shaped prisoners on the outer surface of the joints and a slight opening of the joints themselves, to the extent of perhaps one or two hundredths of an inch. On June 2, 1903, the casing was closed for the last time and the combination of driving mechanisms set to work. The observers were all well protected by the thick piers of the building, while other spectators were kept at a safe distance and well away from the plane of rotation. Two of the observers watched the pointer of the tachometer through opera glasses, another kept the time, while a fourth manipulated the driving levers.

As the hand of the speed counter reached and slowly passed the 1,600 mark, the feeling of suspense on the part of those watching reached the acute stage. The pointer crept slowly on and as it quivered on the mark of 1,775, there was a sudden crash, a sound of rending and tearing, and the writer saw the counter shaft inside writhing on the floor like a wounded snake. On stepping outside he was saluted by a shower of falling splinters and fine debris, and was surprised—putting it mildly—to note the disappearance of the greater part of casing and wheel.

Fig. 5 is from a photograph taken immediately after the explosion and shows the completeness of the wreck. The steel rim of the casing was broken off short 6 in. below one of the flanges, and the entire upper half weighing half a ton was projected about 75 ft. into the air and landed some hundred feet away on the campus. (See Fig. 6.) On its way up it carried away part of the cornice of the building, and this collision was probably what caused it to deviate so much from a vertical path. The hub and main spokes of the wheel remained nearly in situ, but parts of the rim were found 200 ft. away, while one large fragment landed on the roof of the building. This sudden failure of the rim casing was unexpected, as it was thought the flange bolts were the parts to give way first. The tensile strength of

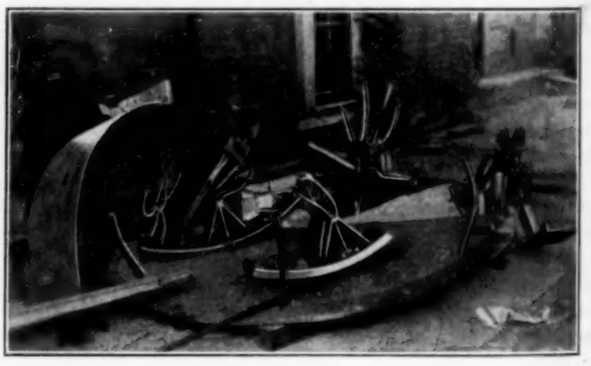

FIG. 5.—AFTER THE EXPLOSION.

the rim at the point of fracture was about 1,200,000 lb., or about four times the strength of the wheel rim at a solid section. Examination of the break in the casing showed a clean, bright fracture, with almost no imperfections. The failure of the wheel itself was due to a gradual opening of the joints, occasioned by the fracture of the outside prisoners

and to flaws in the bronze castings of the arms near their junction with the rim.

On putting the pieces of the wheel together in their original order it was easy to locate the joint which first gave way, on account of the symmetry of the breaks either side of a diameter through this point. It is but fair to the builders of the wheel to say that the fractures showed uniformity of strength and of workmanship, since there was hardly a member or a joint which did not fail in one part or another of the wheel. One thousand seven hundred and seventy-five revolutions per minute means a linear speed of rim of 22,300 ft. per minute, or 372 ft. per second. This is not as great as the probable speed of a solid cast iron rim of good design, but it is greater than the speed of any sectional or jointed rim which has been tested. The tensile stress due to the centrifugal force at this speed is 13,800 lb. per sq. in. This shows that the joints were much weaker than the solid rim. On the whole the test of this particular wheel was disappointing, since its strength was not sufficient to repay one for the expense of the design. Fig. 7 illustrates a model wheel of cast steel which has not yet been tested.

The apparatus for the experiments above described was designed and put in position by Messrs. Moulton and Wachalofsky, members of the class of 1903, Case School of Applied Science, and the tests on wheels Nos. 1 and 2 were made by them. For the experiments on the last wheel credit should be given to Geo. E. Daniels, instructor in mechanical engineering, whose patience and ingenuity overcame all the obstacles to obtaining high speed with so heavy a wheel.

It is interesting to compare the kinetic energy of the rim of the wheel at the recorded speed with the work of destruction. Assuming the rim with its lugs, flanges, etc., to weigh 300 lb., which is a reasonable estimate, the kinetic energy at a speed of 372 ft. per second would be 645,000 foot pounds. Further assuming that none of the energy was dissipated in heat, and that the combined mass of wheel and casing projected into the air weighed 1,500 lb., we find the height of projection to be 430 ft. It is good cause for congratulation that four-fifths of the energy *was* dissipated.

FIG. 6.—FRAGMENTS OF CASING.

The experiments which have just been described make it clear that more than ordinary precautions must be taken to insure safety. The method adopted by an engineer in Germany for testing emery wheels, seems to the writer well adapted for this purpose. It consists in mounting the wheel to be tested on the lower end of a vertical shaft and sinking the apparatus in a hole in the ground. The writer hopes to be able to make some experiments on large wheels during the coming year. A pit about 5 ft. in diameter by 3 or 4 ft. deep will be excavated in a gravelly soil, sheet piling being used to enclose the sides. The wheel will be fastened to the lower end of a vertical shaft, running on specially designed thrust bearings and driven by a friction

FIG. 7.—CAST STEEL MODEL WHEEL.

speed controller at the top. A steam turbine will be used as a motive power, since this is easier to regulate and less susceptible to injury than the electric motor. Acting on a recent suggestion the writer also hopes to test grindstones and emery wheels in a similar manner.

The tin deposits of the York region, Seward Peninsula, Alaska, have been described by Mr. Arthur J. Collier in Bulletin No. 229 of the United States Geological Survey. Several tons of tin ore have been shipped from the deposits of Buck Creek, and a number of companies operated their claims during 1903. In one instance an average of 27 pounds of concentrates containing 60 per cent. of metallic tin was obtained from a cubic yard of gravel. Cassiterite is found irregularly distributed over an area of 450 square miles of the Seward Peninsula.

Vice Consul General Geo. H. Murphy, Frankfort, Germany, writes that according to the Cologne *Gazette* a fusion of three large machine works in western Germany is planned in order to regulate the manufacture and price of gas motor machines. Combinations of manufacturing companies are now frequent in Germany, the object being to obviate the effects of competition and to economize.

The American Iron & Steel Mfg. Co., Lebanon, Pa., has issued a circular to stockholders suggesting the reduction of common stock shares from 340,000 to 51,000, and assessing each common share $2.50, making it paid up stock. It is said that two-thirds of the preferred stock holders and three-fourths of the common, have assented to the proposed change, so that the necessary action will doubtless be taken at the annual meeting.

EXTENSION OF THE CHICAGO DRAINAGE CANAL.

A work now under way and attracting much attention in engineering circles is the extension of the Chicago Drainage Canal. The plans provide for extending the channel now in use between concrete walls and earth and rock embankment southward for a distance of about 10,700 ft. to the site selected for the erection of the power plant. From this point on, a tail race is to be excavated for a distance of about 6,800 ft. This tail race is to be 160 ft. wide and to be deep enough to afford a minimum depth of water of 22 ft. Section 17 is a wide channel, and the minimum depth of water therein until it enters the upper basin at Joliet will be 10 ft. The mean head for power development resulting from this improvement will be 32 ft. and the net horsepower, figured on an efficiency of 75 percent, and a flow of 600,000 cu. ft. per minute, will be 27,000. The power equipment is to be housed in a structure of concrete and brick construction, and will have ten turbine chambers—three for exciter units and seven for power units. The power units are designed to pass 100,000 cu. ft. at 8-10 discharge. They consist of turbines on horizontal axes capable of generating 6,500 h. p. at full gate under 34 ft. of head at 150 revolutions per minute. Each power unit is to drive one 3,750-k. w., three-phase, 2,200-volt generator. The ultimate discharge of the channel, under present plans, will reach 800,000 cu. ft. per minute. The primary purpose is sanitation, and in attaining that object the extension provides an artificial waterway of great utility and developes water power of immense value.

The following machinery is being used: Ten miles of air pipe; two Rand "Imperial" compressors, each having a capacity of about 2,000 cu. ft.; 32 No. 3¼ Little Giant Rand drills. Working in front of each shovel are seven rock drills; the average depth of holes drilled is 14 ft.; average number of lineal feet drills by each drill per shift of 10 hours, 125. The drills, channelers and pumps are operated by compressed air. Other equipment in use includes four 70-ton shovels having three yard dippers, two stone crushers, capacity 8,000 yds. per day; two portable concrete mixers; fourteen 14-ton locomotives, 150 dump cars, 15 miles track, four track channelers, two hoisting engines, 15 suction pumps, two 40-h. p. boilers, one 80-h. p. boiler, one 110-h. p. power boiler, two centrifugal pumps, electric light plant and machine and blacksmith shop. There are 11 buildings in the camp and about 500 men are employed. The illustrations show the canal work in progress.

FIG. I.—WORK ON EXTENSION OF CHICAGO DRAINAGE CANAL.

Dravo, Doyle & Co., merchant engineers of Pittsburg, representing a number of firms in power plant equipment, report a very satisfactory increase in business. For the Ball Engine Co., of Erie, Pa., they have sold engines in the last three months to the following concerns: Franklin Electric Co., Johnstown, Pa.; Cleveland & Sandusky Brewing Co., Cleveland; Cleveland Provision Co., Cleveland; Williamson Building, Cleveland; Public Hand Laundry, Columbus, O.; Youghiogheny & Ohio Coal Co., Meadowlands, Pa.; Provident Coal Co., St. Clairsvivlle, O.; Gas Machinery Co., Cleveland; Mercy Convent, Pittsburg; Publication Building, Pittsburg; General Castings Co., Verona, Pa.; Barnes & Tucker, Barnesboro, Pa.; Loew Mfg. & Supply Co., Cleveland. For the Harrison Safety Boiler Works, makers of the Cochrane heaters and separators, they have sold during the past six months, 55 heaters, aggregating 79,300 h. p. In Cochrane steam separators they report the largest business in their history in this line. For the DeLaval Steam Turbine Co., they have sold complete turbine plants to McJunkins-Straight Dairy Co., Pittsburg; Weston Elec. Light, Power & Water Co., Weston, W. Va.; Pennsylvania Water Co., Wilkinsburg, Pa.; Potters Bldg. & Savings Co., East Liverpool, O.; Indiana Cold Storage Co., Indiana, Pa.

The Sharon Steel Hoop Co., Sharon, Pa., has opened a purchasing office at 306 Farmers Bank building, Pittsburg, which will be in charge of John R. Hastings, vice president of the company. All sales will be made from the Sharon office, but all materials and supplies will be purchased through the Pittsburg office.

The Cleveland Crane & Car Co. has established a branch office at Cincinnati, located at 2619 Reading road. The company's specialties are cranes, rolling mill cars and plantation cars.

SALESMANSHIP AS AN APPLIED SCIENCE.*

BY R. U. CONGER.

There was a time and state of society when the business of selling merchandise was looked down upon. Trade was deemed ignoble and an occupation unworthy of gifted intellects and refined natures. But that time has long since passed away. At best it was never more than a silly prejudice, based upon ignorance and narrow judgment.

Aside from a few small classes, there are but two methods of earning a living—of acquiring and accummulating wealth—one through the production of commodities, the other through the distribution of commodities; and, in the final analysis, even the producer is a distributer. So that looking at it from that standpoint, we are all of us distributers—salesmen. We are engaged in a profession, which, judged from the standpoint of possibilities and financial rewards, is the greatest in the world. Our merchant princes and captains of industry are but salesmen on the highest rounds of the ladder. Very many of them started in the most humble way, without pull or preference. They worked in harmony with the natural laws of success, either consciously or unconsciously, and their rise in the business world was natural.

Latent in the minds of successful men, there have existed laws, truths and principles which make for success, and if we will only follow in the footsteps of these men, we also may be successful. During scores of years, the same quality of mind which converted the common-place things of every day life,—the falling apple, the steaming kettle, the flash of lightning—into the statement of great principles, has been engaged in the production of merchandise. In a similar manner the details of successful experience have been wrought into equally broad principles governing the disposition of that merchandise for profit; and the vast number of facts and factors which lead to more successful salesmanship, have been corelated, systematized and organized. In other words, a science of statesmanship has been created.

*From an address before the Philadelphia Foundrymen's Association, Dec. 7, 1904.

The intensity of competition, with its ever increasing concessions, rebates and narrowing margins of profit, call loudly for greatly increased efficiency in the selling service of every center of commerce. They call loudly for every man in that selling service, to make himself genuinely fit. The practical application of the laws and principles of salesmanship is the strongest factor in any conspicuous success. The old customs are passing away, a new era in the sale of goods confronts us. The application of the principles of any science constitutes a profession; and a thorough realization of this fact will imbue us with the capacity and pride of the engineer, the zeal of the inventor, and the emergency reserve of the superior executive.

In its broad sense, salesmanship is the sale of goods for profit. It is the element of profit, great or small, which makes the transaction worth while. It is easy enough to dispose of goods, but it is to dispose of them at a profit that requires the exercise of salesmanship. Looking at it from that standpoint, the salesmen of the world are our business establishments. Their object is the sale of goods for profit, and therefore they are composite salesmen. Every one from the president to the office boy is a part of that composite salesman. Each has his duties to perform, which go towards increasing or diminishing the margin of profit; and it is upon the share that he takes in this profit making, that his salary or commission is based.

FIG. 2.—COMPRESSION PLANT FOR WORK ON DRAINAGE CANAL EXTENSION.

Salesmen and Salesmanship.

There are but four kinds of salesmen. There is, first, the wholesale salesman, who sells in large quantities goods to be resold. Second, is the retail salesman who sells to the individual for his own consumption or profit, from an established base. Then we have the specialty salesman, who sells to the individual also for his own use, without that established base, where his customers come to purchase, and fourth, the promoter, who initiates and organizes new enterprises. There are also four factors that enter into every sales transaction. There is, first, the salesman; second, the customer; third, the article to be sold, and fourth, an abstract thing, the sale itself. Yet is must exist, otherwise the first factor has not accomplished much.

In a very broad sense, salesmanship is the power to persuade others to buy at a profit that which we have to sell. It is the power to persuade people, and therefore it is this power of persuasion which we want to possess to a more intense degree. Emerson said: "Not he is great who can alter matter, but he who can alter my state of mind;" and therefore, looking at it from that standpoint, the salesman is unquestionably the most important of these four factors. In that word salesman the emphasis belongs on the last syllable—it belongs on the man. If you make the man right, business is going to improve. I recognize, however, that it is a very easy thing for me to stand up here and say, make the man right, and yet a very difficult thing of accomplishment. No one man can make another man right; he can only help that man improve himself. We are not all born with equal capacities; but any of us can increase our efficiency from the standpoint we have already reached, by properly directed study, and that study should first begin upon ourselves. Here is an instance where we have sound premises to build upon. We know more about ourselves than any one else, and we can analyze ourselves as we can analyze no one else.

There is a duality which runs all through nature. We have the positive heat with its negative cold, the positive light with its negative darkness, and this duality runs all through human faculties and qualities. We have the positive reason with its negative irrationalism, positive judgment with its negative injudiciousness, the positive health with its negative sickness, the positive strength with its negative weakness, positive courage and its negative fear, positive faith and its negative doubt, positive love and its negative hate, and so on. If we will be absolutely honest with ourselves, we will find we have many of these negative qualities, which hinder progress, as well as the positive ones which make up for it, and we will find that these negative qualities are always our weak spots. In this making the man right, it is not enough to stamp out the negative, but we must build up and develop the positive qualities. We each have with us germs of all of these positive qualities, and it is comforting to realize this fact—comforting to know there never was a man so hateful that he did not have flashes of love, so obtuse that he did not have flashes of intuition, so fearful that he did not have flashes of courage, and comforting also to know that we can develop these positive qualities by a scientific method of character building.

The two foundation stones of success in commercial life, in salesmanship, are character and health. By character is not merely meant goody goodism; a man may have a lot of that and go to the almshouse. Character is that central force of real manhood and true womanhood, born of a combination of these desirable positive qualities and faculties, and the net result of which is power to influence. Health broadly defined is that harmonious condition of the triune man—body, mind and soul—which enables the physical organs to perform their functions properly, and promotes the development of positive qualities to a marked degree, and it is this marked degree that counts.

The Law of Suggestion.

The most potent factor in the science of man building, is the law of suggestion. A little study of psychology makes this clear to us. I know that a great many people are scared away from the study of psychology, because it has such a long name, but the study of the human mind, it seems to me, is of wonderful importance.

Scientists are well agreed that our minds are composed of two separate divisions, one the objective mind and the other the subjective mind. Our objective mind deals with the knowledge which we obtain through our five senses. These impressions are stored away in the other side of the mind, the storehouse of memory which is a part of the subjective mind. The subjective mind is also the seat of the finer faculties and qualities, such as courage, faith, loyalty. The subjective mind is amenable to suggestion; that is, it will obey suggestion. The subjective mind will obey suggestion from other minds and from environment, and we can also suggest from our own objective mind, to our own subjective mind. This is auto-suggestion. Now here is the gold in the ore. We can suggest to our own subjective minds that we have courage. We can make this positive statement, knowing it to be a scientific statement of fact. We know this is so and can convince ourselves by positive suggestions that we have courage and that we will be courageous. This makes it easy to do the simple things that require courage, and by doing them as they confront us, it becomes easy to do greater things requiring courage, and we can develop this quality of courage in exactly the manner that we develop the muscles of our arm. Benjamin Franklin understood the effect of this principle, although probably not the principle itself, and he practiced it. He developed without question one of the strongest characters America has ever produced. You will probably remember he had a little chart beginning with courage, faith, loyalty, perseverance, honesty, which every morning he would read over, saying to himself: "I will be more courageous to-day." "I will be more faithful to-day." "I will be more loyal to-day." "I will be more persevering to-day," and so on, and we can well afford to dwell upon this subject.

Courage is a great commercial asset with which few others can compare. It is essential in the administration even in the household, in the government of servants. It marks the great editor. It marks the great merchant. It marks the great salesman. Its absence upon the part of a salesman absolutely kills his usefulness. Its absence is pitiable in a professional man. I do not mean physical courage. I mean mental courage, moral courage, and it can be cultivated, just as surely as the rose in our garden. The difference between the ordinary and the extraordinary man, is marked by the degree to which he has some of these positive qualities developed. A man will succeed who has these qualities developed beyond the ordinary man. The mystery of the greatness of great men decreases in direct proportion with our nearness of approach to them, and why? It is because we recognize in close association, which of these positive qualities have been developed so as to make them stand out beyond their fellows.

The Customer.

Some of these positive qualities are combinations, such, for example, as tact, which is a combination of intuition, judgment and brotherly kindness. It becomes a part of the salesman's personality, when intuition, judgment and kindness have been so cultivated as to enable him to appreciate quickly all the present and prospective circumstances surrounding the situation, and to say or do skillfully that which is most appropriate to the person, the occasion, the business in hand or the ultimate end in view. This quality of tact is never available except through character reading. And this brings us to the second factor in a sales transaction—the customer. It is of tremendous importance that we should be able to read human nature, to measure the customer, to get his mental diameter and mental circumference. In the school of experience, we get much of this knowledge of human nature, and we have no great respect for the long haired exponents of phrenology and physiogomy. I doubt if a man would allow us to feel the bumps on his head, if we so desired, when we called to sell him goods. There is

much, however, to be learned from a study of basic and decided types, and as hard headed business man you cannot afford to cast aside the researches of scientific men on these lines.

Has it ever occurred to you that the world is divided into easily distinguishable classes of men—lookers and thinkers—and that it is very dangerous to attempt to handle the looker as you would the thinker, and the thinker as you would the looker? In this scientific reading of human nature, there is something which goes farther than anything of which we have thus far spoken, and that is the silent voice of intuition, which tells us what to do, and when to do it. It is the silent voice of the soul. Intuition belongs to the sub-conscious personality, absolutely independent of reason and judgment. I know a great many people think that women have a corner on this commodity, but they have not. It is a fact that women are more highly developed intuitively than men, but there is a reason for it. It is a generally accepted fact that the intuitive faculty develops in direct proportion with the development of the other positive qualities, moral and spiritual. Custom, prejudices, heredity and habits of life have made women better than men. They are more moral and more spiritual, and naturally would be more highly intuitive.

It seems to me here is a place where the moral and spiritual in business life ripen into a wonderful commercial asset, for no man can estimate the dollars and cents value of the faculty of intuition.

We do not know the whys and wherefores, but we know that in our experience we have had our reason and judgment tell us to do one thing, and our intuition another, and we found after a lapse of time that our intuition was right.

There is one more point in connection with this second factor. There are but two channels by which we can reach the minds of men. One is through the reason and judgment, the other through the emotions. How many salesmen make the great mistake of pounding away at the head all the time, forgetting that they might occasionally plant a solar plexus blow upon the heart. There is an old saying that every heart is a harp of a thousand strings. Prof. Vaught says there are but 42, but 42 is a great many, and it is our duty, as salesmen, to reach and play upon those chords, and we can do so consciously if we know the methods.

The Article to be Sold.

Now for the third factor—the article to be sold. Science does much for us in this connection and it is in the study of the simple laws of analysis, synthesis and logic, that we can accomplish a great deal. This will help us to know more about our own particular business. There are scientific methods by which a man can analyze that which he has to sell. If we will develop his analytical powers, he will be enabled mentally to dissect, literally pick to pieces his proposition, so that every one of its salient selling features will be clearly and distinctly defined in his mind, and then by means of synthesis, he can construct these elements into logical arguments. He can so present its features that they will naturally appeal to the minds of his customer.

There is only a certain number of reasons why any man should buy any particular thing, and a thorough analysis from the standpoints of cost, utility, durability, application, and so on, will enable any salesman to fill his sleeve clear to the shoulder with salient selling features, and then he can let these out in their proper order, if he trains his mind to think in a logical manner. The world to-day wants hard-headed logical thinkers and talkers. The verbal cyclone, the human windmill, and the animated talking machines are out of date in the business of selling. A pound of logic is worth a ton of talk.

Taking up the fourth factor, the sale itself. Here is where the profits are made, and science does much for us, especially the science of psychology. I shall take up but one of these laws, however, because lack of time prevents my going very deeply into this, and it is the mental law of sale.

Did it ever occur to you that none of us ever acquires anything without our minds passing through certain definite processes? For instance, I may be walking in a garden. My attention is attracted to a rose. I take an interest in it. It desire it. I resolve to possess it; and I reach down and pluck it. In the rapidity of their action at times, these processes may be so close together that they seem simultaneous, but there is a dividing line. This is the law: Attention properly sustained develops into interest. Interest augmented becomes desire; and desire intensified ripens into resolve to buy. You cannot get away from this law, any more than you can get away from the law of gravitation, if you jump off the top of a barn. This law was very forcibly illustrated a few years ago, during the bicycle craze. You have all seen riding to work on bicycles men who could not afford to have a warm lunch, while those machines at the first cost anywhere from $100 to $125. Their attention had been attracted to them, their interest aroused, their desire created and their resolve to buy intensified, until they bought those bikes in spite of their reason and better judgment, in obedience to this natural law.

Advertising is but salesmanship by a literary method, and sometimes resolve to buy has been created before the salesman sees the customer. In this case all he had to do was to wrap it up and get his money. Then the clerk of the order-taker type does the business; but, assuming that the advertising had only called the subject to the attention of the customer, or even aroused interest, it is for the salesman to intensify that interest into desire and to produce the resolve to buy. The highest type of salesmanship is that which is required to carry a customer's mind through all four of those processes.

The Salesman's Work Analyzed.

The salesman must command attention, arouse interest, create desire where desire did not exist before, and make that resolve to buy. This is an exact law of nature. The influence of your suggestions upon the sub-conscious mind of a man, is in direct proportion with the intensity of his attention. People sometimes might think this hypnotism, but a slight review will clear our minds. Hypnotism is merely suggestion carried to its ultimate. You remember we said the sub-conscious mind will obey suggestion. If we can set aside the objective mind of a man entirely, our suggestions will go direct to his sub-conscious mind and he will obey them. You all have seen a hypnotist work, and you will remember that he will focus the eyes of his subject upon some very bright light, or will close the eyes to make inoperative the optic nerve. He would have nothing odoriferous around; he would have everything absolutely quiet to shut off the sources of the objective impressions. Then he must have a willing subject, one who is willing to be hypnotized, one whose reason and judgment are in harmony with the operator's. Now, if just for the space of a second he can get the objective mind set aside and have his will and judgment in harmony with his if he says to the subject, "You are a king upon the throne," he is a king on the throne in his mind. If he says, "You are a ditch-digger," he will get right down and dig a ditch. Why? Because his subjective mind is amenable to suggestion and will obey suggestion.

Now this condition you cannot get in a business trans-

action. In the first place, we do not have very willing subjects; in the second place, the mind of a customer is trained to focus his objective forces upon a business transaction, and in the third place, it would be impossible to get a condition where there were not detracting influence or interruptions. We could not hypnotize a man to do business with him, if we wanted to, and we would not want to if we could. But the influence of your suggestion upon the sub-conscious mind of a customer is in direct proportion to the intensity of his attention, and this thought is well worth while remembering. "The world stands aside for the man who knows where he is going." It is for us to know where we are going. Lincoln at 22 years of age said: "I will study and get ready, and then maybe the chance will come." Opportunity is our next door neighbor. She is like a wise young woman, who engages the attention of many men, hoping to find one who is fit to develop her latent powers, but opportunity is a very good judge, and we must make ourselves fit if we would wed opportunity.

So all these principles of which I have spoken would be as faith without works, were it not for one other law, and that is the eternal law of hustle. It is this law of hustle that makes us realize that the reason most men do not accomplish more is because they do not attempt more. It is this law which makes us realize that genius is only energy intensified.

I never think of that word genius that I do not recall what Paderewski said to Queen Victoria. She had commanded him to play before her, and afterwards complimented him upon his genius. He answered: "Yes, your majesty, the world now calls me a genius; but there was a time when I was only an ordinary piano player. Yet I made up my mind that the world should call me a genius; so I practiced hours, days, weeks, months and years, and finally the world called me a genius. But before I was a genius, I was a drudge, and that is what we all must be, not in the sense of slaves, but in the sense of loving labor for labor's sake and the rewards that it brings."

I never think of this law of hustle that it does not make me realize the value of the margins of time. You remember what Garfield said when asked why he was the best Latin scholar in college. "You know Jones, who recites next best to me. Well, his room is right across the campus there, and I can see his light and I have learned that he studies his Latin lessons the same hour I do, which is just before we retire. So I watch his light, and when I see that light go out I study fifteen minutes longer, and there's where I've got him." That is the principle that carried Garfield from the canal boat to the White House. Other things being equal, it is the hustler who hustles as long as the next best hustler, then hustles fifteen minutes longer, who breaks the record.

This philosophy is summed up in Hamilton Wright Mabie's expression: "'Practice makes for skill, discipline for character, and the accumulation of knowledge for intelligence; but none of these processes bears its ripest fruit until by vital assimilation it passes on into culture and becomes a part of the man himself." Knowledge has dennite stages. A man must not only look, but see; not only hear, but understand. Knowledge passes from the stage of knowing to understanding, and then to the next stage, realization; and there is a vast difference between knowing a thing and realizing it. The last stage is where it becomes a part of man. This last stage is faith. There are five links in this chain of faith: First, faith in God; second, faith in ourselves; third, faith in our fellowmen; fourth, faith in our business; fifth, faith in our employers. When we have the chain complete, it becomes literally true that "according to your faith be it unto you."

PRODUCTION OF TIN IN 1903.

One of the series of monographs published by the United States Geological Survey is a 19-page pamphlet by Joseph Struthers and Joseph Hyde Pratt, dealing with tin production in 1903. As in former years, there was no commercial production from domestic tin ores in the United States last year, though many hundred tons of metallic tin and chemical salts of tin, chiefly chlorides, have been obtained by chemical or electrolytic treatment of new tin scrap from tin can and fruit tin factories. The treatment of new tin scrap, known as "detinning," has become of considerable importance in the United States. At least ten companies were engaged in this branch of the industry during 1903. The amount of tin recovered each year in this way is steadily increasing and the industry is of some considerable importance. The principal companies utilizing old tin cans and other scrap tin as a source of the metal are the Vulcan Detinning Co., with plants at Sewaren, N. J., and Streator, Ill.; the Ammonia Co., of Philadelphia, and the Johnson & Jennings Co., of Cleveland and Chicago. In recovering the tin the scrap is digested in an alkaline solution, and the tin electrolytically precipitated therefrom in the form of a powder which averages 80 percent metal. There is, in addition, a number of concerns which recover tin from old tin cans by smelting treatment in the furnace, the tin being obtained in the form of solder.

While the mineral cassiterite, or tin dioxide, containing 78.6 percent of metallic tin, has been found in 17 states and territories, in only two or three have attempts been made to put the industry in this country on a productive footing. The noteworthy deposits are those at Harney Peak, in the Black Hills of South Dakota, those in North and South Carolina, and the deposit in Alaska. In none of these have developments been carried to a commercially productive stage.

The report describes the tin belt of the Carolinas and the geology and mineralogy of the district. The first production of tin ore was in the summer and fall of 1903, when 38,471 pounds of tin concentrates from the Ross mine were shipped to England for treatment.

The world's production of tin in 1903 was 93,893 long tons, of which 54,797 tons came from the Malay States, 20,060 tons from the islands of Banca and Billiton, 9,50 tons from Bolivia, 4,150 tons from Cornwall, 4,991 tons from Australia and 395 tons from miscellaneous sources. The imports into the United States in 1903 were 44,028½ tons, valued at $23,618,802. The United States consumed 43 percent of the entire production of the year, Great Britain 28 percent, other European countries 22 percent, and India and China 7 percent.

Though there has been a slight increase in the total production of tin each year, the supply does not equal the demand. The statement of stocks on hand each year for the past seven years in England, the United States and Holland, in addition to stocks afloat, gives a total of 40,101 tons in 1896, 34,937 tons in 1897, 23,353 tons in 1898, 20,681 tons in 1899, 20,377 tons in 1900, 25,620 tons in 1901 and 16,419 tons in 1902. The report says: "These figures illustrate emphatically the need of new sources of supply of tin and show why new deposits like those in the Carolinas and Alaska should be thoroughly investigated."

The statement of average monthly prices of tin shows a range from 22.48 cents to 32.74 cents per lb. in 1899, of 26.94 cents to 33.10 cents in 1900, 24.36 to 28.60 cents in 1901, 23.54 cents to 29.85 cents in 1902, and 25.42 to 30.15 cents in 1903.

It is the expectation that the National Tube Co. will begin the manufacture of wrought pipe at Lorain, O., early in the new year. When the great plant is running full, several thousand men will be given employment. At South Lorain 200 houses are now under erection to take care of the first influx of new employes, and it is expected 500 or 600 additional houses will be built before the end of 1905.

PERSONAL.

W. A. Thomas, of Niles, O., has been elected president of the Niles Iron & Sheet Co., Niles, O., succeeding James S. Patterson, of Struthers, O. H. M. Robinson and John McVey resigned as directors and their places have been filled by the election of Ira Thomas and Clinton G. Thomas, both of Niles.

The official staff of the Pittsburg-Buffalo Co., of Pittsburg, has been slightly changed as a result of the lease and sale of some of the company's coal properties to the Pittsburg Coal Co. H. P. Jones has resigned as general manager of the Pittsburg-Buffalo Co. and has been elected president of the Big Hill Coal Co., of Richmond, Ky. Thomas R. Jones, formerly vice president, has accepted the presidency of the Pittsburg & Buffalo Co., of Buffalo, N. Y., and will hereafter make his headquarters at Buffalo. The Buffalo company is a selling agency.

Thomas Parrock, manager of the Youngstown, O., mills of the Republic Iron & Steel Co., has tendered his resignation to take effect the first of the year. He was formerly superintendent of the upper and lower mills of the American Steel Hoop Co. and is well known in iron and steel circles in the Mahoning and Shenango Valley districts.

Bernard McGuckin, who has had charge of one of the blast furnaces of the South Sharon, Pa., plant of the Carnegie Steel Co., has been appointed superintendent of the company's blast furnace at the North Sharon works. This stack will be blown in shortly.

Joseph Hartley has resigned as superintendent of the Genesee Iron Co.'s plant at Charlotte, N. Y., to become superintendent for the Londonderry Iron & Mining Co., at Londonderry, Nova Scotia.

W. J. Sando has been appointed manager of the Allis-Chalmers Co.'s pumping machinery department, with headquarters in Milwaukee. He served with the New York City commission on additional water supply from May 1, 1903, to Jan. 1, 1904, as engineer in charge of the pumping department. For a number of years he was connected with the International Steam Pump Co. His five years' apprenticeship as a machinist was with the Dickson Mfg. Co., Scranton, Pa.

Obituary.

James H. Williams, founder and head of J. H. Williams & Co., manufacturers of drop forgings, died suddenly of apoplexy at his home in Brooklyn, Dec. 5. Mr. Williams was born at Fort Plain, N. Y., 59 years ago, and established the drop forging business in a small way at Flushing, L. I., in 1882. In 1884 the business was moved to Brooklyn and was incorporated in 1895, Mr. Williams becoming the president. For about 10 years he was a partner in the firm of Bliss & Williams, now the E. W. Bliss Co. The business of J. H. Williams & Co. was highly successful in a financial way and also in winning and retaining the good will of the workers. Mr. Williams was a pioneer in the industrial betterment movement, but believed that at its foundation were good wages. He was a public spirited citizen and interested in religious and philanthropic work.

Thomas Kimball, the first iron founder of the South, is dead at his home in Birmingham, aged 100 years. He made guns for the Confederacy during the civil war, at which time he owned the Tannehill furnace, the successor of which is now the property of the Republic Iron & Steel Co.

The rebuilt furnace at Newberry, Mich., now the property of the Berry Varnish Works, of Detroit, is drawing on the Mary Charlotte mine, at Negaunee, for 10,000 tons of its hard hematite ore, and is making a mixture that works well. This furnace is said to be doing very well, and its large chemical plant is in full operation.

THE BLAST FURNACE SITUATION.

On Dec. 1, according to the monthly report issued by J. G. Butler Jr., president of the Bessemer Pig Iron Association, the United States Steel Corporation had 60 of its 85 blast furnaces in operation, the operative capacity amounting to 74 percent or a total of 23,170 tons daily. However, the Steel Corporation now operates 89 stacks, instead of 85 with which it is credited, and on Dec. 1 there were 29 out instead of only 25. Since the first of the month one additional stack has been blown in at New Castle, while the two Donora furnaces of the Carnegie Steel Co. will be producers of iron this week. By Dec. 19 only 26 of the Steel Corporation furnaces will be out.

The Carnegie Steel Co. operates 51 furnaces, of which only five can now be counted on the idle list, as follows: One furnace at North Sharon, Sharon, Pa.; two furnaces at Columbus, O.; one at Zanesville, O.; and one at the Isabella plant, Pittsburg. The National Tube Co. has two stacks idle, one at Lorain, O., and one at Steubenville. The latter stack may never start again. The American Steel & Wire Co. has three furnaces out at Troy, N. Y., two at Cleveland and the Neville and Edith stacks at Allegheny. The Illinois Steel Co., according to this recapitulation, has seven or eight idle furnaces, due no doubt to the shutting down of its rail department and Bessemer works. The idle stacks will no doubt be placed in operation shortly after Jan. 1.

Orders to blow in the two Donora furnaces of the Carnegie Steel Co. were issued last week and caused some surprise, inasmuch as the stacks have been in condition to run for more than a year, and less modern plants have been started up in preference to these stacks. The furnaces when acquired in the purchase of the Union Steel Co. by the United States Steel Corporation were under construction and were completed under the supervision of the Carnegie Steel Co. Each stack is 85 x 22 ft. and eight Kennedy stoves 100 x 24 ft. are provided. They are equipped with two pig casting machines and have an annual estimated capacity of 365,000 tons.

The monthly report issued on Dec. 1 by J. G. Butler Jr., president of the Bessemer Pig Iron Association, is as follows:

Company	No. of Stacks	In	Out	Daily Capacity Tons	In	Out	Per Cent In	Per Cent Out
U. S. Steel Corporation	85	60	25	31,261	23,170	8,091	74	26
Bessemer Pig Iron Assn.	16	14	2	4,110	3,635	475	88	12
Republic Iron & Steel Co.	4	4		1,020	1,020		100	
Pensylvania Steel Co. and others	86	66	20	20,404	16,261	4,143	80	20
Total	191	144	47	56,795	44,086	12,709	78	22

The report shows that only two of the furnaces of the Bessemer Pig Iron Association are idle and since this report was compiled one of these stacks was blown in, the Ella furnace, at West Middlesex, Pa. The active capacity from the beginning of the year is as follows:

January 1	35½ percent.	July 1	65 percent.
February 1	62 "	August 1	59 "
March 1	72 "	September 1	72 "
April 1	85½ "	October 1	74 "
May 1	80½ "	November 1	75 "
June 1	80 "	December 1	78 "

The Jackson Iron & Tin Plate Co.'s plant at Clarksburg, W. Va., has been sold under a bankruptcy proceeding for $62,600 to the bondholders of the company. The plant, which was built two years ago at a cost of $160,000, will resume work immediately, employing 300 men.

A number of officers of the United States Cast Iron Pipe & Foundry Co. were in Cincinnati recently, and it is intimated their inspection of the Addyston plant of the company was with a view to its enlargement.

Two Virginia blast furnaces are making preparations for early resumption.

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AN EXTRAORDINARY PACE OF PRODUCTION.

It is difficult to realize the pace at which the American iron trade is now traveling. The resumption of operations has been made so quietly, and our production was so large during the period of depression, that failure to grasp the magnitude of the current production is easy. That many do so fail is patent.

The country is now making pig iron at a rate close to 19,000,000 tons a year, greatly exceeding the actual production in any given calendar year. It is most significant that the weekly capacity of the active coke and anthracite furnaces is to-day practically 370,000 tons, whereas at the opening of the year it was 185,636 tons, or only half as much. Such a recovery is unparalleled in any iron producing country. In the Pittsburg district but four blast furnaces are now idle, and these for special reasons. In the Shenango valley only two or three furnaces—merchant interests—are idle, outside of some practically abandoned stacks. In the remainder of Western Pennsylvania there are no furnaces idle except two stacks never yet operated, and one undergoing an absolutely necessary rebuilding. In the Mahoning valley there are only one or two regularly operative furnaces idle. In this great district there is really a greater production than can be expected normally, from the ordinary necessities of relining and other repairs. In the Southern district the only curtailment is on account of fuel difficulties. In the East, imports are expected rather than that many of the Eastern furnaces now idle should resume. From the fairly large additions to our pig iron capacity there must probably be deducted, to arrive at net results, a fairly large capacity scattered over the country not likely to participate in production except under the most unusual conditions, so that the present productive rate is really quite significant.

In the lighter lines of steel products there is intense activity, considering the season of the year and the actual ultimate consumptive demand. One must go back to the summer of 1903 to find as many tin mills in operation as there are this month. At this time last year, in a phenomenal burst of production which accumulated very large stocks in the warehouses of the leading producer there were not as many mills active, nor were there last summer at the height of the year's consumptive demand. In sheets, wire, merchant pipe, etc., the conditions are different in degree only, and not in kind. While the actual orders placed for steel cars make a much smaller aggregate than current reports would indicate, they are nevertheless sufficient to keep all the steel car capacity of the country fully engaged.

The fact that the general consuming trade for iron and steel products is still some distance from attaining the appetite it had in 1902 is no criterion of the actual production of iron and steel at the present time. The point should be emphasized that so far as production is concerned the trade can have very little cause for complaint, nor can it complain that there are not buyers for all the material that can be furnished. The only point which can possibly be considered weak is that a great deal of material is going, not into final consumption, but to replenish stocks in various hands, but that such replenishing is more or less of a necessity as preparation for the large movement into final consumption expected next year can hardly be denied. Jobbers and consumers of iron and steel products proper were really not carrying the supplies last summer which would be necessary for the transaction of business in any ordinarily active times.

A NEW RATE OF IRON CONSUMPTION.

In the alternate fevers and chills which periodically overtake the iron trade the most cursory notice of development shows clearly that the expansion of demand is much more rapid than the expansion of productive capacity. From a chill during which the buying of the consuming class is reduced and the capacity of the producing class is incompletely employed the recovery of the buying class is always more prompt and more complete than the recovery of the producing class. A study of relative productive capacity and actual production at different periods indicates this quite distinctly, but still more eloquent is the showing of the price movement. A single instance of this principle may be cited from the history of the recovery from the depression which started in 1893. Without any study of the actual development one would be disposed to say that the real recovery from this depression occurred in 1899. That year was marked by a truly spectacular advance in prices of all iron and steel commodities, advances coming in a single week which in previous years were impossible in a month or in three months. Yet the absolute fact is that the recovery in demand came much earlier. The year 1897 broke all previous records for pig iron production, yet the increase from 1897 to 1898 was actually greater in tons than was the increase from 1898 to 1899. In percentage it was naturally much greater. In no subsequent year has the percentage increase of production been as great as from the record-breaking year of 1897 to the record-breaking year of 1898. Had the manufacturers been inspired, in 1896 and 1897, with that confidence which following events showed would not have been misplaced, they would have engaged in large new erection. The enormous advance in prices in 1899 would not have come, consumption would have been much larger than it was, and the chill felt in 1900, now almost forgotten, but then quite distressing, would have been avoided. There was no disinclination to consume in 1900: there was simply the unavoidable disinclination to buy when prices start tumbling from a lofty height. The high prices of 1899 did few interests any material good.

At the present time the American iron trade is in much the same condition as at several times in the past. There has been a chill owing to certain temporary influences curtailing for a brief period the buying inclination of the country. Its consumptive inclination has continued to expand. There has been an indisposition to embark in large new ventures, yet it is obvious that the most moderate adherence to previous rates of increase in consumptive demand will very shortly give employment to all the productive capacity now in existence which has any business right to be engaged. In 1902 and 1903 we made about 18,000,000 tons of pig iron, with prices which brought into operation equipment which had no great economic right to run. With the present an off year, consumptive demand next year can without the slightest difficulty reach the equivalent of 20,000,000 tons, enough to keep employed not alone the moderately good plants, but many whose owners could not seriously complain against fate if they were left behind. Nor is there any reason to expect the growth to stop with 1905. The consumption of light lines, such as wire products, sheets and tin plates, has been growing apace through thick and thin. Merchant pipe even this year makes an increase over 1903 and should show further gain in 1905, owing to heavy line pipe engagements. Rails are destined to have off years but occasionally, as rails are now bought for replacement rather than extension. Structural material is being used more and more. The most moderate orders for steel cars, hardly making up for worn out equipment, have been sufficient in the past two months to put all the steel car plants on full time, with increases in rolling stock yet to be provided for. The advent of the steel railroad tie is even nearer than its friends have been predicting in the past year or two, with an enormous tonnage unavoidable. Not only the lesson of history but the actual tangible developments of the day point to a continued and enormous growth of the steel business.

It is of minor consequence if the evidence is not complete as to a very large increase in ultimate consumption at this season of the year. Blast furnaces and steel plants require a long time to build. It is necessary to look not one month or one year ahead, but two years at the least. Within two years there may even be surprise that capitalists were so diffident and so unwilling to draw conclusions from the previous vitality of the American iron industry. That period can easily show the *raison d'etre* of a large increase in capacity for producing pig iron, steel and finished products. The fact that stands out most prominently in the record of all the fluctuations in consumption of iron in the United States is that after a period of depression or of arrested demand the pace at which the country resumes the free use of iron and steel is not the old one. Every year brings its increment not only of population but of per capita consumption, so that following each dip below record consumption momentum is gathered which carries the wave of prosperity well beyond the old bounds, which in the interval had seemed so difficult of ever being reached again.

The Pencoyd mills of the United States Steel Corporation, near Philadelphia, are again presenting scenes of activity. Many orders have recently been received and large additions to the working force are being made. The Steel Corporation has recently placed large orders for basic iron to cover the needs of the Pencoyd plant.

THE LAKE SUPERIOR CORPORATION.

The $300,000 of interest due Dec. 1 and later to the Ontario government and the New York bankers' syndicate that has been assisting the Lake Superior Corporation, has been met. There is now a more general feeling in Canada that the government did the right thing in assisting the Clergue enterprises by the loan of its credit to the extent of $2,000,000 and that these enterprises are now in position to make their way. It is understood that the money paid this month as interest was from net earnings of those portions of the works that are so far occupied. The Ross government's action in assisting these enterprises was severely criticised at the time, and was bitterly fought by some members of parliament. But Premier Ross and the government pointed out that it was not for the relief of the investors in Clergue industries, nor of Mr. Clergue, an American, but to aid the whole development of the district about the north and east sides of Lake Superior, which would be dealt a blow that would be effectual for many years if these industries should go to the wall.

The Canadians do far more along the lines of paternalism than does the United States or any other democratic government. Canada's chief asset is undeveloped lands and resources, which if they can be brought into activity by development, will push the country toward the front rank at a rapid pace. Western Canada is now proving the results of this policy in the splendid development of its lands toward the Rocky Mountains, lands which but for the building of government-aided railroads, and the sale of large tracts at low prices to colonization enterprises, would be generations in getting on the tax rolls. But these lands have within two years made Canada a leader in export wheat, taking the place of the Northwestern States, and it is progressing at a rate not dreamed of by those not intimately associated with its progress.

The new corporation is now making a profit, it is asserted, on an output of steel rails amounting to about 500 tons a day, and is filled up with orders for a considerable period ahead. The importation of rails duty free ceased in November, and all these recently imported rails are to be laid by February or become subject to duty. The Sault works are so far the only Canadian rail mills. There is a duty against foreign countries of $7 a ton, and a bounty on steel made of imported iron ore of $2.25 more. In addition to this is a further protection, specifically against "dumping" amounting to half the duty. Besides its output of rails the company is making 100 tons of wood pulp daily, at a profit estimated to amount to $6 per ton. It is making 225 tons of pig iron daily, and will be in condition in a few months to increase this by 150 tons more, when its charcoal furnace is in operation. Its woodworking industries are to be in operation as soon as the effects of the policies that prevailed during the greater part of the receivership have been overcome. These policies, which were doubtless required by the situation, did not permit the accumulation of a large supply of raw material for future operation. The general feeling in Canada seems to be that the company is on its feet.

Favorable reports continue to be received respecting building operations in all sections. During the month of November, according to reports to *Construction News*, permits were taken out in 25 of the principal cities of the country for the construction of 8,228 buildings, involving a total cost of $31,812,850, against 6,336 buildings, aggregating in cost $25,385,951, for the corresponding month a year ago, an increase of 1,892 buildings and $6,426,899 or 25 percent.

The American Sheet Steel Co. is adding another mill at its McKeesport, Pa., sheet plant. It will be ready to operate shortly after the first of the year.

The Labor Situation.

THE YOUNGSTOWN HOOP MILL STRIKE.

The announcement was made Dec. 13 that another department of the hoop mills of the Carnegie Steel Co., at Youngstown, would be started on double time next week. Preparatory to that, 20 men were brought into the upper plant. They are said to be an expert crew for the rolls. President Shaffer of the Amalgamated Association said that there would be no attempt made to declare off the strike. If this is done, he asserted, the men must take a referendum vote; then the district committee must act on it and finally it must be referred to the advisory board for its ratification. The assertion is made by the union that 50 percent of the strikers now have permanent jobs at other points.

ACQUITTED OF MANSLAUGHTER.

In the case of Fred C. Wolff, the non-union workman in the hoop mill of the Carnegie Steel Co., at Youngstown, who shot and killed two union strikers Oct. 22 after they had assaulted him on the street, the trial of the charge of manslaughter resulted Dec. 13 in a verdict of not guilty. The trouble grew out of the strike at the mills.

METAL TRADES ASSOCIATION NOTES.

CINCINNATI, O., Dec. 13.—Commissioner Eagan of the National Metal Trades Association is in New York city this week. He addressed the New York Metal Trades Association at their monthly meeting Dec. 8.

It is reported that dynamite was again used on the Newport Iron & Brass Co.'s building on Sunday evening, Dec. 11, destroying a portion of the roof and doing some damage to the core room.

The molders' strike at Cincinnati is occasioning but little inconvenience now to the foundries as a rule and they are operating with lessening difficulty.

It is reported from Pittsburg that labor conditions in the metal trades are generally without note and everything is moving along smoothly. However, considerable activity in a quiet way is apparent among several of the prominent local labor organizations.

The Cincinnati Metal Trades Association held a foreman's meeting on Thursday evening, Dec. 8, which was well attended.

LABOR NOTES.

Some twenty steel workers employed on the construction of the N. & W. R. R. bridge across the Scioto river at Portsmouth Junction, went on a strike a few days ago, under orders from a walking delegate of the national organization. The company proposed arbitration, but it was refused. The men demand 50 cents per hour and nine hours' work. They have been receiving 45 cents per hour for nine hours' work.

President Joseph F. Valentine, of the Iron Molders' National Union, says that the New York agreement was fair to both sides and he regrets that the National Founders' Association has withdrawn from this agreement. He predicts that matters will now be back in the old way, making disturbances and interruptions which will unsettle business.

E. A. Rysdon, a Chicago sheet metal contractor, who for nearly two years waged a bitter fight against the Building Contractors' council and the Sheet Metal Workers' union, has at last given up the fight. Last week he discharged all his non-union men, paid his fines to associations of both employers and employes, amounting to $3,000, and signed a closed shop agreement with the union.

The Republic Iron & Steel Co., Youngstown, O., placed additional puddling furnaces in operation this week at its Brown Bonnell plant.

LAKE SUPERIOR IRON MINES.

Lake Superior Corporation's shipments from its Helen mine for the year have been 117,153 gross tons, making 909,106 for the four years of the mine. A crew is maintained in the mine this winter, developing ahead, and the expected shipment for next year is larger than for this season.

While putting in and changing some steam pipes at the Hull mine, Mesabi range, a few days ago, the water got such headway that the pumps were drowned out and the mine became flooded. Bailers are now in use but it will be ten days or two weeks before the mine is open for regular operation. Since the closing of the Penobscot there has been a redistribution of the pumping problem in the Hibbing district and the Hull is getting its share.

The state of Minnesota receives this year from its iron ore mines, in royalties, $49,000 and in lease and contract payments about enough to make the gross receipts $80,000. Practically all ore mined has been from the state end of the Burt pit, at Hibbing, which is operated by the Oliver Iron Mining Co., though the Scranton, Oliver, Grant, Frantz, Yates, Wanless, Woodbridge, and some others paid their minimums.

On the final day of shipment the steam shovel operated at the Cambria mine stockpile, Negaunee, loaded 112 40-ton cars during the 10-hour shift.

Killorin & Philbin Co. will strip all winter at the Monroe-Tenner, and in order to do this without letting frost get ahead of them they will work day and night, for the seven days of the week, without interruption. During cold weather the ground in front of the shovels will freeze so deeply that work is delayed, unless the machines are kept digging steadily all the time. It was found last winter at the Holland mine that stripping by hand day and night was about the simplest way of getting around this difficulty, as there was not so much ground opened ahead and the men worked without interruption.

Drilling for ore has commenced on the farm of Ole Lovequist, 8 miles east from Brainerd, Crow Wing County, Minn. This is on account of the talk of ore near Aitkin. Several drills are working in the latter district, but so far as the public—iron men included—can find out good ore is scarce there.

S. R. Elliot, who has been superintendent of the Crosby mine, western Mesabi, for the Cleveland-Cliffs Co., has become superintendent of its Negaunee and Maas mines, at Negaunee. The Cleveland-Cliffs Co. has brought suit against the original lessees of the Crosby, charging that the amount of ore in the ground was overestimated at the time of their purchase and that they overpaid by $98,000. They paid an excess royalty of 7 cents per ton, cash on all ore in sight, and were to pay the same amount on all additional ore to be found by their explorations, which were to be carried on continuously till the whole property was shown up. On commencing to operate the mine and to explore the tract, they found that the mine had been seriously overestimated and they have endeavored to get back the overpayment. They disclaim any thought that the East Itasca Mining Co., the name of the defendant concern, was trying to get payment on ore they did not suppose to exist.

Hereafter the management of the several properties of the Cleveland-Cliffs Iron Co. will be under a different system. Mining engineers have been promoted to the positions of superintendent in charge of certain mines, and under them will be the mining captains, whose duty it will be to direct underground work. W. W. Graf will have charge of the Cliffs shaft and Moro mines, S. R. Elliott will be superintendent of the Maas and Negaunee mines, and H. C. Dudley will direct affairs at the big Ashland mine at Ironwood. A superintendent for the Cleveland Lake and Salisbury mines is yet to be announced.

It is reported that the blast furnace at Embreeville, Tenn., will start up again about Jan. 1 on special iron.

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The 14th annual meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club on the evening of Dec. 7, with a very good attendance. The officers nominated at the previous meeting were unanimously elected, as follows: President, Thomas Devlin, of the Thomas Devlin Mfg. Co.; vice president, Alexander E. Outerbridge Jr., of William Sellers & Co.; treasurer, Josiah Thompson, of J. Thompson & Co.; secretary, Howard Evans, of the J. W. Paxson Co.; executive committee, H. O. Evans, Thomas M. Eynon, E. E. Brown, R. C. Oliphant, Thomas B. Harkins; trustees, Thomas Devlin, Josiah Thompson, Howard Evans; official chemist, George C. Davis.

In accepting a re-election President Devlin thanked the members warmly for the honor done him, and called attention to the fact that not only was the Philadelphia Foundrymen's Association the first organization of its kind in this country, but it was also the one which had been followed in the establishment of district and national associations devoted to the trade. The association is now in a prosperous financial condition, the treasurer's report showing that it has a fund of $1,679 and no debts.

In place of the usual technical paper President Devlin introduced as the speaker of the evening, Roy U. Conger, of the Sheldon School of Scientific Salesmanship, New York, who gave an interesting address on "How to Sell Goods—at a Profit." It is given elsewhere in this issue.

Mr. Conger's address was very well received, and after several members had briefly commended his views the thanks of the association, on motion of W. J. W. Moore, were voted him. Technical discussions were omitted for the evening, and the meeting was followed by a lunch at which short addresses were made by Mr. Conger, Secretary Howard Evans, and others. The following were present at the meeting:

Thos. Devlin, Thos. Devlin Mfg. Co.
T. J. Kelly, Thomas, Roberts, Stevenson Co.
O. J. Ward, Howe Scale Co.
J. Thompson, J. Thompson & Co.
T. B. Harkins, T. B. Harkins Foundry Co., Bristol, Pa.
Luther Shick, Isaac A. Sheppard Co.
C. D. Orr, Thomas, Roberts, Stevenson Co.
W. J. W. Moore, Rogers, Brown & Co.
H. W. Yost, Thomas, Roberts, Stevenson Co.
S. C. Wells, North Wales Foundry Co., North Wales, Pa.
Adam Pugh, Isaac A. Sheppard Co.
Walter M. Whorder, W. O. Steele, Bateman Mfg. Co., Grenloch, N. J.
J. C. Boyer, J. K. Dimmick & Co.
Arthur Simonson, Wm. Wharton Jr., & Co.
W. P. Cunningham, American Bridge Co., Pencoyd, Pa.
R. W. Belfield, H. Belfield & Co.
Frank Krug, Jos. Dixon Crucible Co.
Edw. J. Bergen, Bement, Miles & Co.
W. J. Devlin, Thos. Devlin Mfg. Co.
Walter McDonald, C. Gorman, Schaum & Uhlinger.
F. C. Pullman, J. Wesley Pullman.
A. A. Miller, *Iron Age*.
H. L. Tripple, Fairbanks Co.
Geo. C. Davis, Chemist.
C. W. Sprague, Thos. Devlin Mfg. Co.
John F. Hoy, Bement, Miles & Co.
Wm. Burns, Penn Steel Casting Co., Chester, Pa.
Hy. D'Olier Jr., Thos. Devlin Mfg. Co.
Hy. J. O'Neill, Philadelphia Hdw. & Mall. Iron Co.
Saml. H. Truitt, H. Belfield & Co.
L. Silvester, J. Wesley Pullman.
S. A. Cocaran, Frank Samuel.
Stephen Luther Sinclair
Frank Tickner, Supt. foundries Illinois Steel Co., Chicago.
W. S. Bickley, Penn Steel Casting Co, Chester, Pa.
W. H. Hartman, Girard Iron Works.
Edw. Decker, Paul S. Reeves & Son.
H. J. Fueller, Abram Cox Stove Co.
H. A. May, Theo. B. Rohrman.
L. A. Nickerson, Thos. Devlin Mfg. Co.
D. J. Thomas, Eynon-Evans Mfg. Co.
T. Burd Zell, Penn Steel Casting Co., Chester, Pa.
Wm. C. Russell, *The Iron Trade Review*.
J. W. Haslan, Frank Samuel.
Wm. B. Franklin, U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Howard Evans, J. W. Paxson Co.

Jones, Caesar, Dickinson, Wilmot & Co., certified public accountants, have arranged to extend their practice on the Pacific coast and for that reason have opened an office in the Mills building, San Francisco, where their business will be carried on under the management of G. R. Webster, chartered accountant and certified public accountant, and F. J. Phillipps, certified public accountant. Mr. Webster has been associated with the firm for many years as a manager, and Mr. Phillips, who was formerly associated with the firm, has for the past three years been in practice in San Francisco as a public accountant. His business will be continued as part of that of the firm.

La Belle Iron Works Plate Mill.

The La Belle Iron Works, Steubenville, O., have awarded contracts for the erection of an 84-in. plate mill, the United Engineering & Foundry Co., Pittsburg, having the contract for the erection of the mill and tables, while Mackintosh, Hemphill & Co. will erect the engine and shears and the Riter-Conley Mfg. Co. has the contract for the erection of the buildings. The mill will be three-high, of modern construction, and will be operated by electrically driven tables. Mackintosh, Hemphill & Co. will furnish a 44 x 60 Corliss engine, having a 24-ft. flywheel, weighing 15 tons and made in 12 segments. This company will also furnish two plate shears. The La Belle Iron Works will erect two buildings, the one to contain the mill and tables and the other for stocking and shipping the plates. The main building will be 200 x 150 ft., having two 100-ft. spans and commanded by two 25-ton cranes. The stock and shipping department will also be 200 x 100 ft. There will be a stock yard run 150 ft. long. Each building will be 35 ft. high and all cranes will be electrically operated. About 500 tons of structural material will be required in the erection of the buildings and the stock yard run.

Lengthening Lake Vessels.

The steamer G. J. Grammer, which was built by the American Shipbuilding Co. in 1902 for Frank Seither, of Cleveland, will be lengthened 72 ft. this winter by the same company. The ship is 366 ft. over all and 48 ft. beam. The addition will make her 438 ft. long and will increase her carrying capacity about 1,300 tons, making it 6,200 tons. The cost of lengthening the steamer will be about $75,000. The reconstruction of the Grammer shows how rapidly changes come into the lake trade. The vessel has been afloat only three years and is already out of date. President Wallace, of the American Shipbuilding Co., says that the lengthening of vessels may become an important factor in shipyard work. He states that the steamer Republic, which represented an investment of $100,000 in 1903, was breaking about even on current freight rates. Last winter the vessel was lengthened 72 ft. at a cost of about $70,000, and this year she paid in about 8 percent on the total investment. Repairs on the steamer S. S. Curry, owned by H. A. Hawgood, of Cleveland, which will cost about $35,000, will be made by the American Shipbuilding Co. this winter.

The open-hearth plant of the North Sharon, Pa., works of the Carnegie Steel Co. was placed in full operation this week. This plant has been idle for nearly a year and the tremendous increase in the demand for steel products necessitated the operation of this mill. The plant contains six furnaces. The three stacks at South Sharon were compelled to bank their fires this week on account of the shortage of water and unless the rivers rise very soon the operation of the entire South Sharon plant will be seriously interfered with. The plant of the American Steel & Wire Co. at this place resumed in full this week.

The Bethlehem Steel Corporation has been incorporated under the laws of New Jersey with an authorized capital of $30,000,000 and will succeed the United States Shipbuilding Co., now in the hands of a receiver. The incorporators are George H. Sheldon, Charles S. Fairchild, John E. Borne, Pliny Fiske, Max Nathan and Charles W. Wetmore. Of the capital, half is to be preferred stock, with 7 percent non-cumulative dividends.

Annual Meeting of the American Society of Mechanical Engineers, at New York.

The fiftieth meeting of the American Society of Mechanical Engineers was held in New York, Dec. 6 to 9 inclusive. The annual address, given in our last issue, was delivered by President Ambrose Swasey at the opening session on Tuesday evening, Dec. 6. This meeting and the one held on Friday morning were in the auditorium of the society house, but on account of the limited size of this room the sessions of Wednesday and Thursday took place in the hall of the Mendelssohn Union on West 40th street.

TUESDAY EVENING.

The unveiling of a portrait of Past President John E. Sweet at the opening session was the occasion for still another cordial recognition of the place held by the genial professor. It was a time for due appreciation of his long and altogether admirable connection with mechanical engineering and the opportunity was promptly utilized. These tributes of regard for a man invariably free from the influence of mere shop custom and apt to throw precedent aside when better things are in sight, were spontaneous and emphatic. Prof. Sweet as the founder of the society was the subject of a formal address by Chas. W. Hunt, and when at the "critical temperature" the members saw the flag removed from the likeness of the engineer, who was then appropriately seated beneath the portrait, the applause was prolonged.

President Swasey's address attracted much attention. It dealt with matters closely related to astronomical mechanism, and, as Mr. Swasey's firm, the Warner & Swasey Co., of Cleveland, has been identified with the Lick telescope and other scientific apparatus of considerable celebrity, his discussion of 'Some Refinements of Mechanical Science" was keenly appreciated. To many it proved a distinct revelation of the patient skill involved in close approximation to exact measurements. Following the delivery of the address came an informal reception and smoker.

WEDNESDAY MORNING.

Secretary F. R. Hutton in the course of his report on membership said that this was the banner year of the society. The total number of members of the three grades is 2,801, and 262 have been added to the roster during 1904. President Swasey called upon Chas. W. Hunt and John Fritz to present the president-elect, John R. Freeman. Mr. Freeman said, in acknowledging the courtesy, it was an excellent custom that he just now appreciated all the more, that the president had a year in which to prepare his address.

Union Engineering Building.

Chas. W. Hunt, of the committee on union building, reported that the ground had been cleared and considerable progress made of a preliminary character, though the plans were not complete. Some unanticipated difficulties had also arisen in connection with the best plan of legal control for the new building. Two of the societies had a charter of incorporation, but the American Institute of Mining Engineers was not so incorporated and a mere partnership was considered impracticable. The tax assessors of New York exempt scientific organizations, but a company formed for the management of the building might easily be held as a purely business enterprise, and, once on the tax books, not readily removed. A charter was now being prepared to meet these exigencies and would be somewhat on the plan of the one governing the Cooper Union of New York. Much care was requisite in the drafting of an instrument of the kind, as a thorough search had failed to find any precedent to guide the lawyers. Mr. Hunt was of opinion that in two months more the plans and charter would be in final form.

Gus. C. Henning announced for his committee that a fund of some $700 had been collected for a bronze memorial bust of the late Dr. R. H. Thurston. A design had been submitted to the committee but was not found satisfactory and another one will be obtained.

Henry H. Suplee responded for the committee charged with the historical record of the society. He acknowledged the receipt from Prof. John E. Sweet of letters and circulars sent out by the founders of the organization. The earliest meetings were held in the offices of the *American Machinist* and Mr. Bailey, at one time part owner of that journal, had sent some important data. Photographs of the building at 96 Fulton Street, New York, where preliminary meetings took place and of the hall at the Stevens Institute at Hoboken, N. J., where the meeting for formal organization was held, have been secured by the committee. Mr. Suplee said that his committee desired further material showing the inception and progress of the society as well as in the field of mechanical engineering in general. He was supported by Mr. Hunt, who hoped that the collection now in hand might be increased ultimately to form as notable an exhibit as the one at South Kensington, London Mr. Suplee reported also for the joint library committee of the union building. The library will be on the top floor of the union building, and while the books of the society will be brought together this will be accomplished without any of the several collections losing their identity.

Prof. D. S. Jacobus and William T. Magruder of the mechanical section of the American Society for the Advancement of Science tendered an invitation to the members to attend the meeting in Philadelphia.

Fuel Testing Plant at St. Louis.

Col. E. D. Meier spoke on behalf of the continuance of the United States Government fuel testing plant at St. Louis. Congress made an appropriation of $20,000 and the installation has been of a practical and working type. There are three boilers, a gas producer and engines at the exhibit in the mining gulch at the exposition. The appropriation made by Congress carried a stipulation that all apparatus must be donated, but the condition had proved no barrier to the enterprise and manufacturers have supplied the necessary means for the work. Plain grates were employed. Owners of coal mines were invited to send their product for examination. Only a carload was accepted from each mine, this contingent upon the approval of an inspector. The plant was installed late in the exposition season but has made a record of 85 tests and the work should be kept up. From 100 to 150 additional samples have been offered for testing purposes, and it is proposed to secure another appropriation from Congress. Mr. Hemingway, chairman of the House Committee on Appropriations, supports a donation of $100,000 and hopes the plant will be made permanent. The appliances now in place can do much service in another six months and the apparatus supplied to the installation can be readily held that length of time. In charge are Prof. J. A. Holmes, chief of the Department of Mines and Metallurgy, and E. W. Parker, statistician of the United States Geological Survey. The secretary was

empowered to prepare a circular on the subject for transmission to the membership. It is likely that congressmen will soon be acquainted with the merit of the fuel testing plant through their mechanical engineering constituents.

A New Hydraulic Experiment.

The presentation of professional papers was the next order of business and the first on the list was "A New Hydraulic Experiment," by A. F. Nagle. This was read in abstract by Secretary Hutton. The author considers the rise of water in a standpipe, having a long supply pipe, when the draft ceases suddenly. He points out that there has been much discussion, but so far as his knowledge goes no experiments have been made in the case of the standpipe supplied by a long pipe or tunnel from a distant reservoir and furnishing water to pumping engines, to determine the height the water will rise in the standpipe when the engines suddenly cease to operate. The paper describes several experiments made with a barrel filled to overflowing with a hose, the surface of the water in the barrel being maintained 46 in. above the floor. A ½-in. pipe, 48 ft. 2 in. long, ran from bottom of barrel to within 10 in. of the floor, followed by a cast iron elbow and vertical riser. A cast iron T was inserted in the riser, 5 in. above the ½-in. pipe, and in the side opening a bib cock was fitted for drawing water into a pail. A glass water tube, 0.6-in. internal diameter, was attached above the T. In later experiments an inch pipe was substituted for the ½-in. and a wrought iron pipe, 1 in. in diameter, replaced the glass tube, a full one inch plug cock taking the place of the bib cock. A large cork float with a long thin stick of wood indicated the water level in the riser tube. Several tables are given in the paper and plotted in diagrams to illustrate the action of the column of water in the riser when the flow is under experiment. A formula is derived and examples given to show its application to practical problems.

George W. Colles called attention to the fact that the height to which the water will be raised in the standpipe by the sudden shutting off of the flow represents the maximum pressure at the base of the standpipe only in cases in which there is little or no head of water in the standpipe when the water is flowing. He was of opinion that the author's equations are in most practical cases useless or at most but partial determination of the maximum possible pressure in the pipe. Mr. Colles proceeded to show that the equations of the paper have no application to the case of an ordinary water pipe which has no standpipe attached and are misleading in other practical cases. For example, a long turbine penstock, where the water is allowed to reach considerable velocity and is then suddenly shut off or violently checked at the lower end, would burst if not provided with relief valves, although the height to which the water would rise in a standpipe of enlarged diameter would be insignificant.

Prof. R. C. Carpenter pointed out that he had described an experiment of substantially the same general nature in volume 15 of the *Transactions*, under the title of "Some Experiments on the Effect of Water Hammer." The experiments were made on a 2-in. pipe and the velocity of flow was measured by a Pitot tube. A valve was connected to the pipe which could be suddenly opened and closed as desired. The static pressure on the pipe averaged close to 27 lbs. The pressure produced by the sudden closing of the valve depended upon the velocity of the flowing water, how suddenly stopped and whether or not an air chamber was used. The resultant pressure in a pipe without air chamber went in some cases to 300 lb., or more than ten times the initial static pressure. Prof. De Volsen Wood had presented a formula for theoretical consideration and quite recently the matter has been thoroughly investigated by Prof. M. Jonkovsky at Moscow and the results of all the investigations have been compiled by O. Simin in a paper which is soon to be published by the Association of Engineering Societies. The Jonkovsky experiments were made on large pipes, from 1,000 to 2,500 ft. in length, and were very exhaustive. Prof. Carpenter submitted several of the formulae and tables. The experiments indicate that under certain conditions, when the velocity is arrested in a dead ended pipe, the wave motion from one end may be superimposed on that from the other end and a very high pressure result. The intensity of the shock will be lessened by slowly arresting the velocity of flow and can probably be entirely obviated by closing the gate very slowly.

Henry H. Suplee said that the Jonkovsky experiments will be found in the proceedings of the American Water Works Association. The discussion elicited a reference to the hydraulic ram which was said to be generally supposed a wasteful machine. Anyone with such an impression would be rather surprised on reading some of the claims made by manufacturers of rams.

At the Thursday morning session a communication was received from Sir Benjamin Baker of London relative to Mr. Nagle's paper, and may be appropriately introduced here. It will be seen to support the conclusions of Prof. Jonkovsky as outlined by Prof. Carpenter. Sir Benjamin Baker some twenty years ago was consulted about repeated fractures in a large cast iron pipe about three miles in length, with pumps at the lower end driven sometimes by turbines and sometimes by steam engines and delivering at the upper end into an open reservoir about 90 ft. above the level of the pumps. The fractures occurred about 60 ft. from the engines under a public road. Very large air vessels were introduced and the engines modified in a variety of ways without effect. He ascertained that the fractures never occurred when the pumps were worked by the turbines, so instead of advising a new type of pump, as the authorities expected, he merely ordered a series acting starting valve for the engine, similar to that on the turbines, so that the engines could not be started or stopped in less than a minute. No further fractures occurred, as the latter were obviously due to the column of water continuing to flow on after the pumps were suddenly stopped and then returning with a water-hammer action on the pipe at its lower end. Secretary Hutton, in submitting the communication, said that this was the first instance on record where a European member had had his discussion presented in time to be read at the same meeting with the paper under consideration. It showed the advantage of strictly limiting the time for receipt of papers and the consequent opportunity for further consideration in the added days.

President Swasey expressed his hope that the members abroad would follow the example of Sir Benjamin Baker and send in papers and discussions. The acquaintance of the two engineering societies at Chicago last June would, he trusted, be followed by a closer touch with what each was doing and an exchange of comment and discussion upon the papers presented.

A Twist Drill Dynamometer

Wm. W. Bird presented the paper prepared by Howard P. Fairfield and himself and published in *The Iron Trade Review* of Dec. 8. During the presentation of the paper a number of metal blocks were exhibited to show the curious holes drills are capable of making under peculiar conditions; such as having the one lip considerably longer than the other, etc.

Harrington Emerson commented upon the previous lack of accurate information and suggested further investigation to determine the best angle for drills, the gain

obtained by preceding a large drill with a smaller one, and the relative size the small drill in that case should bear to the large one. Mr. Bird in reply said that the drill with a 45 degree angle, other things being equal, was much better than the drill with standard angle. Fred. W. Taylor proffered the information that William Sellers & Co. of Philadelphia had made experiments with various drill angles and had decided that a 45-degree angle was most desirable for general work. The firm had adopted that angle therefore at the plant. Mr. Taylor said that the hardness of the material worked had a marked relation to the drill angle; the included angle should be blunter as the material cut becomes harder. The discussion brought out the importance of making tests upon commercial drills, the regular drill of the trade, rather than any special tool where the results might be misleading if applied to the drill in common use.

It did not develop during the discussion but is nevertheless a fact that Dr. Nicholson, of Manchester, Eng., whose research in the possibilities of high speed tool steels received much praise at the joint meeting at Chicago last June, has had an extensive investigation of drills under way during the summer. His apparatus includes the Armstrong-Whitworth lathe and special dynamometer already described as well as a drill press adapted to the work of investigation and record. An interesting paper may be expected on the subject, therefore, at no distant date.

Diamond Tools.

The last paper of the session was submitted by the author, G. C. Henning, with a number of sample diamond dies and other tools. He gave a description of the various kinds of diamonds, including a peculiar stone which exploded after removal from the matrix in the mine and exposure to the atmosphere. Diamond dies do not exceed .075 in. diameter and are seldom over .04 in. diameter. Some of these dies are worth as much as $75 and it is common practice to have the holes accurate to .0001 in. In the most improved setting of these wire dies, steel is cast around the diamond to prevent it bursting in use. Thermit is employed to facilitate the casting process. Bronze is next cast around the steel setting to prevent corrosion of the steel by the substances used to lubricate the wire as it passes through the die. It is generally understood, though not mentioned in the paper, that the diamond is plated to improve the close contact of the stone and setting. The diamond is credited with being a good conductor of electricity and is readily plated with the requisite metal deposit.

Discussion of the paper was not offered and adjournment was taken for lunch at the society house.

WEDNESDAY EVENING.

Centrifugal Fans.

The members assembled in the hall of the Mendelssohn Union on Wednesday evening and took up the consideration of professional papers, commencing with the one by A. J. Bowie, Jr., on "Centrifugal Fans." This considered the losses due to sudden change in the velocity of the air, sudden change of direction of the air, air friction, back slippage of air past the running rings, eddy currents, and mechanical friction in the bearings. The author briefly considered these points and described an apparatus designed with the idea of obtaining a suitable velocity gauge for air which would be independent of any existing state of pressure. He claimed that by the proper use of the apparatus the presence of eddies could be discovered and provision made in the design of the fans to eliminate them. He had found it a comparatively simple proposition to determine exactly what was going on at any point in an air path not cut by moving vanes.

Prof. R. C. Carpenter reported that he had been making experimental investigations of centrifugal fans in the past ten years. He was sorry to say that the paper had not added anything to the stock of knowledge regarding this important class of machinery. The paper said that "waste space is a thing to be avoided in fan design." If this statement means that a larger clearance space is not desirable between the fan wheel and the casing, he could not agree with the author. The results of an extended series of experiments have shown that clearance space between the casing and the fan wheel is of great importance. In a large measure the efficiency of the centrifugal fan increases with the form and capacity of the clearance space. The form of the casing and the form of discharge pipe are of great importance, practically as well as theoretically. He objected to the statement that the Pitot tube is an instrument suited only for rough approximation in this work and also to the implication that the tubes shown as something new are not forms of the Pitot tube and that they are essentially different from those previously used by other investigators. The accuracy of the Pitot tube for measuring water has been well established by exhaustive experiments on many forms of nozzles and also in connection with various differential gauges. The accuracy of this tube for measuring air was established by the Prussian Mining Commission in 1884. It calibrated various measuring appliances by the aid of a gasometer containing 70,000 cu. ft. and Prof. Carpenter had employed the Pitot tube extensively for measuring the velocity of air.

Some mention was made of the remarkable characteristics of the Sirocco fan and those in possession of data were invited to contribute to the discussion, but no information was volunteered in reply.

Computation of Water Power Values.

An abstract of the paper entitled "Some Details Entering into the Computation of the Values of Water Powers, and the Damage Caused by the Diversion of Water Used for Power" was given by the author, Chas. J. Main. It gives definitions of market value and damage and methods of determining value of an undeveloped water power and of damages. Diagrams show multipliers for various ratios of pondage to rate of 24-hour flow; relation gate opening bears to power developed, water used and efficiency of turbine water wheels; number of months when water should be allowed to waste with different sizes of steam plants and different costs of water power; extra length of time engine would have to run if installed after diversion; estimated cost of producing one horse power per year of 3,080 hours in compound condensing engines with coal at $3, $4 or $5 per long ton. Other diagrams deal similarly with running costs of simple condensing and simple non-condensing engines. The subject is an involved one and all the varying conditions of different industries, as pointed out by the author, have the effect of producing a sort of average selling value for water purposes but each case requires examination and estimates of its own. The paper was not discussed.

An Indicating Steam Meter.

This paper by C. E. Sargent was read in abstract by Secretary Hutton and describes a device for measuring the amount of steam delivered through pipes. The author says that meters having an adjustable opening through which the steam flows have been made and with a constant pressure record fairly accurately the pounds of steam passing through them but with a variable pressure from the nature of the device the indication would be inaccurate. Water in the steam pipe will also impair the accuracy of a meter susceptible to derangement by impact. The device described is believed to meet all the requirements of practical use.

G. C. Henning considered the device very ingenious

but one that would require frequent examination as to the effect of the steam coming in contact with the surfaces, for corrosion would thereby result. He mentioned particularly certain parts as liable to impairment by the action of the steam.

Henry H. Suplee said that a meter had been developed in Germany in which there was a correcting template to counteract the objection made in paragraph twelve of the paper. This paragraph has been quoted substantially in the above abstract from the paper and deals with the accuracy of meters having an adjustable opening. Mr. Suplee intimated that a number of the meters he had mentioned had been put to use abroad.

Stay Bolts, Braces and Flat Surfaces.

R. S. Hale discusses the problem of the support of flat surfaces as in the design of fire boxes of locomotives and upright boilers, the combustion chambers of Scotch marine boilers and in the heads above the tubes in horizontal tubular boilers of all classes. He submits the maximum working stress permitted by the United States rule, the British Board of Trade and other authorities and points out that none of these, except the practice of the Hartford Boiler Insurance Co., take any account of the difference in stress between long and short braces. Tables are given showing permissible pressures by various rules for certain thicknesses of plate and from 4 to 11 3-16 in. pitches. Mr. Hale comes to the conclusion that for long steel stays, subtracting ⅛ in. from the diameter and then allowing 12,000 lb. per sq. in. on net section, the remainder gives results apparently better than any of the present rules. For iron stays probably 10,000 should be used. For short stays which are chiefly iron, where the bending action comes in, empiric rules reducing stress as length of stay decreases may be used. Our knowledge of the bending stress is not sufficient to warrant the use of a more theoretical formula. He also submits a simpler formula for pitches and gives values to insert for riveted stays, stays nutted or crowfoot stays riveted on and for the use of washers, channels or angle bars riveted on.

Geo. R. Henderson called attention to the locomotive boiler where the requirements are unusually severe. He had had an experience with a boiler of this class and a bulge between the staybolts in the water leg had led to an investigation. The water leg had been drilled from the outside and tubes inserted reaching to within a short distance of the inside plate. Gauge cocks were attached to the outer ends of the tubes and when the engine was at rest showed water, of course. When the boiler was driven hard and the gauge cocks opened, the tube coming close to the inside plate showed steam. Wm. T. Magruder gave some experience with the Belper boiler and the spheroidal condition and W. S. Huson reminded the members of a bulged plate which was exhibited to the society at a meeting some years ago and then provocative of discussion. The plate was quite clean as submitted for inspection but the impression of the members was that it had been dirty at the time of failure.

Condensers for Steam Turbines.

George I. Rockwood in his paper on the above subject comments upon the relative inconspicuousness of the turbine itself in the midst of the numerous and large condenser auxiliaries. In the case of the smaller turbine plants the floor space occupied by the condenser system far exceeds that required by the turbine. There appear to be three accepted designs for these condenser systems. First, the combination consisting of a surface condenser, a centrifugal hot well pump, an air cooler, a single cylinder dry vacuum pump, a centrifugal circulating water pump, together with their connecting and drip piping and valves. Second, the above arrangement may be varied by omitting the hot well pump and the air cooler and dry vacuum pump, substituting the wet vacuum pump—preferably of the Edwards type. The cost per kilowatt is about the same—$7 to $10—for either of these systems. The third system is like the first, except that an elevated jet condenser with barometric tube and hot well takes the place of the surface condenser and hot well pump. The advantage of this third type over the surface condenser systems is that it may take up less floor space while its cost is but $5 to $6 per kilowatt. The dry vacuum pump used with barometric condensers must have a two cylinder air pump and the exhaust steam from the turbine cannot be again used in the boilers. The whole cost of a condenser system is not fully expressed by the condenser contractor's contract. The turbine room is made a full third larger and the smaller the turbine plant the larger this part of the cost becomes relative to that of the whole power plant. A fourth type of condenser is of the injector or ejector class and the author describes such a condenser system applied to a 400 kilowatt Westinghouse-Parsons turbine. A vacuum of 28 to 28½ in. is maintained by a 16-in. Bulkeley injector condenser. The arrangement of the piping and some unexpected results achieved by changing injection pipe to a vertical position, the cost, and other important items are enumerated at length in a paper all the more interesting and valuable because it treats of what is probably the only instance on record of the use of injector condensers for large turbines either of the Parsons or Curtis type.

Francis Hodgkinson commented on the paper as follows: The vacuum obtained with an ejector condenser without the use of a separate air pump seems very remarkable. I should think, however, a very small air leak would seriously impair its vacuum. Mr. Rockwood bears witness to having a particularly tight piping system. The installing of an air pump would make this installation closely resemble the well known barometric condenser, and would seem to me to be an insurance of at least a fair vacuum should any of the apparatus be deranged or small air leaks develop, and would add practically nothing to the operating expense so long as no big air leaks exist.

I desire, however, to call particular attention to the 16-in. exhaust line 20 ft. in length and having three short turn elbows over which no drop of pressure could be observed. The Westinghouse-Parsons turbine, which exhausts into this condenser, showed the following results in a test, when operating with 28-in. vacuum, 150 lb. brake horsepower, and 100 degrees superheat.

Br-ke H.-P.	Total lb. steam condensed	Lb. steam per brake H.-P. hours
588	7639.5	12.99
419.8	5759	13.71

When delivering 350 k. w. the steam consumption would closely approximate 6,767 lb. per hour, but as superheat is not being used at the present time, the consumption of steam would be within a very few percent of 7,520 lb. per hour. With this consumption, the dryness factor of the exhaust steam would be 0.908, and disregarding the water, the velocity in the pipe is 454 ft. per sec.. Supposing the exhaust pipe to be a well rounded orfice of 100 percent co-efficient and assuming the steam to be starting from rest, there would be a difference of pressure of 0.136 in. of mercury when passing this quantity of steam. Of course, a well-rounded orifice as above is assumed to be entirely without friction, and is a very different thing to 20 ft. of pipe and three short elbows. I would have expected in the case of the exhaust pipe a back pressure of at least half an inch of mercury with the same quantity of steam.

Mr. Hodgkinson added that it is very easy to be deceived in reading low pressures and mentioned one test where differences of pressure were frequently indicated that could not possibly exist. He had found that one of the pipes con-

tained a quantity of water and because of capillarity and the smallness of the pipe would not drain away. He also gave plan and tables prepared during tests where he had had occasion to observe drops of pressure over an exhaust pipe with varying quantities of steam and vacua.

Joseph Morgan commended the paper as giving valuable information for engineers contemplating the use of condensers for turbines. He said: In a steam turbine unit under a jumping load, a jet condenser means continual waste of water or occasional disastrous loss of vacuum. An electric lighting plant is, of course, more easy to handle than an electric power plant, as the fluctuations of load are more gradual and can be met by the necessary adjustments of water supply to the condenser. On our Johnstown city lighting plants we are still able to divide the loads among our various generators by hand adjustments of field rheostats, but in our Cambria Steel Works power plants we have on a 1,200 kilowatt plant frequent fluctuations of 600 kilowatts, lasting a few seconds or a few minutes, to which the steam governors must respond, and with variations in steam consumption which any satisfactory condensing plant must take care of. I doubt the ability of such a plant as Mr. Rockwood describes to meet such conditions. We have had in Cambria Works considerable experience with such jet condensers on automatic rolling mill engines. We were annoyed by their blowing off under sudden loads, and also found them wasteful of water, so that they have been replaced by several central condensing plants of the Weiss type. In some of these Weiss units we have arranged to take as much as 10,000 horsepower and the steam from ten large engines into one condenser. Owing to the extent of the piping systems, the large cubic capacity of the exhaust space and the great body of water always in the condensers, the load fluctuations produce relatively small and temporary effects. We have carried the steam in some cases through 1,500 feet of piping and have noted, as Mr. Rockwood has, the very small pipe friction. The vapor in the pipes under vacuum is so attenuated that its velocity is exceedingly great. We carry the exhaust steam, for instance, from our 1,200 kilowatt electric plant through 950 ft. of 24-in. pipe, and a total distance of 1,000 ft., to a central plant at the blast furnaces. This is about 50 percent more steam than we had originally intended to put through this pipe, but under extreme fluctuations we drop momentarily less than 2 in. in vacuum. In another plant we carry the exhaust steam for a 500 h. p. rope haulage compound engine through 1,000 ft. of 14-in. pipe to a large exhaust main, and thence 500 ft. farther to the main condenser, with excellent results. I can testify to the very satisfactory result of the water packing on the turbine shafts, as mentioned by Mr. Rockwood. It has been applied to the two turbines at the Broad street plant of the Citizens Electric Co., New York, replacing the original steam packing with more satisfactory results as to tightness and saving of oil.

The subsequent discussion called attention to the daily variation of the barometer and in this way some peculiar differences of reading could be reconciled. Mr. Suplee suggested that the barometer variation locally was about 2 in. in the past three months and it would be possible by checking the tests on record with the official readings of the barometer in each place to ascertain how much of the difference at the test was due to atmospheric changes. One speaker mentioned his experience with the ejector condenser in the hope of attaining greater flexibility, "a rubber neck to the nozzle" as he jocularly termed it, but had not been able to supply the need.

THURSDAY MORNING.

Bursting of Four-Foot Fly-Wheels.

The paper by Prof. Chas. H. Benjamin was first on the list at the session of Thursday morning and appears in full elsewhere in this issue. G. C. Henning was of opinion that these admirable tests show that fly-wheel rims should be made of steel. Steel rims could easily be welded and are much stronger than any cast iron rims. George R. Stetson spoke of the slipping of the belt on the wheel and the consequent heating of the rim. He believed that the slipping of the wheel through the belt is often sufficient to cause the rim to expand and leave the spokes. Some experiments on this line would therefore be interesting. J. E. Johnson, Jr., suggested a change in the common form of wheel design. The connections of a jointed rim are now midway between the supporting spokes and there is a cantilever action. The spokes could be brought in touch with the flanges at the joints and the latter arranged to connect equally with the supporting spokes, the greater weight of the rim at the flanges then coming directly in line with the retaining member. F. A. Halsey suggested to Prof. Benjamin the advisibility of testing the wheel shown by Mr. John Fritz some years ago. This had a remarkable design and the joints could be made with an efficiency of 100 percent, something that could not be said of any other fly-wheel. The design referred to by Mr. Halsey is in a paper entitled "Rolling Mill Fly-wheels." This is in volume 20 of the *Transactions*, page 944, and is numbered 823.

Influence of Connecting Rod Upon Engine Forces.

This paper by Sanford A. Moss is intended for simply and yet exactly taking account of the influence of weight and inertia of the connecting rod upon the forces transmitted by the ordinary slider crank chain such as is used in steam and gas engines. The method of treating the influence of the connecting rod by assuming that it is partly rotating and partly reciprocating is not new but the present investigation and the mathematical determination of the fractions into which the rod weight must be divided has some claim to novelty. It is somewhat of a coincidence that shortly after the first draft of the paper was prepared an article by Prof. Dr. R. Mollier appeared in the *Zeitschrift des Vereines Deutscher Ingenieure* and the final result which Prof. Mollier reaches is identical with the statement made in the first sentence of paragraph 22 of the present paper. A portion of the subject is however treated by wholly different methods. The paper is not readily abstracted and received little comment, G. R. Henderson alone touching upon the conclusions reached in paragraph 22 in reference to the reciprocating rate.

Losses in Non-Condensing Engines.

The author, J. B. Stanwood, has been interested in the possibility of increasing the economical performance of non-condensing steam engines operating under varying loads and contributed to the discussion on the report of the A. S. M. E. Committee on Standardizing Engine Tests. He then called special attention to two factors representing respectively the condensation and expansion losses. The present paper is an extension or elaboration of the discussion upon the relation of these losses, particularly such as occur in non-condensing engines. The tests of a few leading types of these engines which have been analyzed in order to determine current practice and some of the conditions governing steam economy under varying loads are also given. The paper has a number of charts and tables but owing to a misunderstanding by the printer there are sundry important changes to be made prior to incorporation in the *Transactions*.

Power Plant of Tall Office Buildings.

The paper by Sterling H. Bunnell involved a comparison between compound and four-valve simple engines running non-condensing, and a table of data obtained from seventeen plants, exhibits the actual cost of current as compared with the rates charged by central stations. A number of diagrams were laid out from actual indicator cards produced by Watertown en-

gines of the usual high speed non-condensing type. The author is convinced that the four-valve engine gives very much better steam distribution and economy than the compounds. The re-evaporation during expansion even at light loads is not great and does not indicate any such loss of efficiency as is due to the large gaps of the compound diagrams. He further asserts that the figures indicate that the single cylinder four-valve engine has a far greater range of capacity with reasonable economy than the non-condensing compound engine and for the actual conditions of service in power plants of large buildings is much to be preferred. Too frequently contracts are let on the basis of the best load performance guaranteed, in spite of the fact that in buildings where most of the electric current generated is used for power by the various auxiliary machines and the elevators, the full load capacity is only infrequently and momentarily required.

F. H. Ball took exception to the methods and conclusions of the paper and exhibited on a chart the results of a large number of tests reported by George H. Barrus in his book entitled "Engine Tests." All of these tests were run non-condensing and most of them were on Corliss engines. We were told by the author of the paper under discussion that the compound engine is less efficient than the four-valve type without light load. The curves of the chart contradict the conclusion announced in the paper. Mr. Ball said that it was interesting to note in this connection the result of a test of a 75 h. p. single valve compound engine with 100-lb. pressure, non-condensing. The test was carefully made with a surface condenser and the results could be accepted with confidence. In this case the test covered almost exactly the same range of load as the test of the Corliss engine shown on the chart and the efficiency is practically the same at every stage of load. In making this comparison it must be borne in mind that, first, the 75-h. p. compound is being compared with a 300-h. p. Corliss; second, that the Corliss engine was one that made the best showing in Mr. Barrus' book; third, that the short stroke four-valve engine without releasing valve gear cannot possibly make as good a showing as the average Corliss engine and must therefore fall considerably short of the exceptionable performance of this Corliss engine. The conclusions drawn by the chart examination are these: First, that a single valve compound engine is more economical than the best type of Corliss engine of the same horsepower capacity and considerably more economical than any four-valve engine without releasing gear; second, that the greater efficiency of the compound engine when compared with the simple four-valve engine is just as noticeable with light loads as with heavy ones.

J. B. Stanwood using the analysis described in his paper, had taken Mr. Bunnell's table 2 with engines under atmospheric exhaust, and calculated the cylinder efficiencies. As 16.7 lb. is the theoretical minimum water rate for 110 lb. boiler pressure by gauge, then the ratio of 16.7 to the expected water rates of Mr. Bunnell gives for each example three different cylinder efficiencies. These values for two engines only (one compound and one simple), are plotted and show plainly the advantage of capacity possessed by the simple engine, and of efficiency by the compound engine. Mr. Bunnell assumes a condensation loss of 20 percent with equal light loads for both types of compound engines. As the engine with governor controlling the valve gear of the high pressure cylinder only has a greater temperature range at light load than the other, it would probably be found in practice, all things equal, to have a greater initial condensation than the engine in which the valves of both cylinders are under governor control. For high back pressures and 110 lb. boiler pressure, Mr. Stanwood advised a cylinder ratio of about 2 to 1 as it would give capacity with only a slight reduction in economy over the larger ratio. Diagrams taken from a slow motion 11 x 16 x 20-in. cross-compound throttling engine, high pressure cylinder steam jacketed, has shown a maximum of 49 lb. mean effective pressure, boiler pressure 116 lb. by gauge, cylinder ratio 2.12 to 1, high pressure cut-off 50 percent. When engines are working into a heating system, high economy with light loads is not necessary, as usually there is a large demand for exhaust steam.

Pressures and Temperatures in Free Expansion.

This paper gives a series of pressures and temperatures shown in tabular and graphic form and obtained experimentally by A. Borsody and R. Campbell Cairncross. Dr. Chas. E. Lucke presented the paper and explained with the aid of the blackboard the arrangement of the experimental apparatus, etc. It was intimated that the experiments were made with an ordinary De Laval nozzle and Secretary Hutton said that the tests were made with the ultimate object of being useful in the design of turbines driven by gas. Reginald P. Bolton thought the paper had value as a contribution to the study of heating apparatus. The passage of live and of exhaust steam gave rise to peculiar action which could profitably be studied with the aid of the diagrams and tables illustrative of the flow through orifices.

The Subway Power House.

The members adjourned for lunch at the Society House at noon and the local committee provided escorts for a visit of inspection to the power house of the New York subway, which is located at 59th street and the North river. This exemplifies the very latest practice in large power plant installation and attracted a corresponding degree of attention. It is somewhat curious that some of the handsome cars employed in the Subway are made of metal and others of wood. This diversity occasioned some comment. It was obvious that in case of an accident metal was the least perishable material and the disaster would not be likely to have the added horror of fire as in the case of wood. This assertion was met with the objection that if the metal did not catch fire it would certainly serve as an excellent conductor of electricity and probably the resulting connection with the third rail would prove just as destructive to life as in the other case. It was further pointed out that in the event of a collision or other accident tending to jam the car tightly in the tunnel, the unfortunate passengers would not be as easily extricated from the crushed cars. These and other suggestions show that something is to be said pro and con about the very handsome metal cars of the New York subway.

Thursday evening came the reception at Sherry's. This is the distinctively social event of the meeting and was largely attended. Dancing followed the reception and the efforts of the local committee and officers of the Society to have the time pass pleasantly and profitably were untiring and successful.

FRIDAY MORNING.

Fuel Consumption of Locomotives.

This was the first paper of the closing session and was presented by the author, George R. Henderson, with the aid of the lantern. He alluded to the fuel bills of a railroad as one of the largest items of expense and yet there was probably less known about it than any other account. The reason for this lack of information is obviously due to the difficulty of subdividing the quantities of coal in proper proportion to the work done on each of the various grades. The author made a complete series of tests with the standard heavy freight engines of the Chicago & Northwestern railway and using these tests as a foundation has elaborated a diagram to give at once the coal consumption per mile or per hour for various grades and speeds or train loads for any particular locomotive. The construction of the diagrams is made clear in the paper.

Harrington Emerson said the stock of engineering data bore a strong resemblance to the map of Africa of a few years ago. Portions were well explored but large tracts looked

bare. For example, the transmission of heat through the walls of a gas engine cylinder was up to a short time ago left unnoticed in the literature of engineering. It was the same in the case of railroad practice. Steam had many pages, but the important matter of coal received little attention and the present paper was all the more interesting.

Prof. R. C. Carpenter was of opinion that the paper presented gave a valuable method for rationally computing the fuel consumption of locomotives for different conditions of service and will be found of permanent value for estimating the performance of locomotives. An interesting statement was made on page 3 of the paper with reference to the limits of consumption of coal per square foot of grate area per hour. The limits are stated as follows:

Bituminous coal	200 lb.
Anthracite, large sizes	100 lb.
Anthracite, small sizes	60 lb.

These figures show the enormous quantities of coal which may be burned per hour in locomotive practice. These amounts are so large that they are not even approximated in any other case where coal is used, so far as the professor knew. He had made a recent investigation which compared with the statements of the paper and indicated that the relative amounts of the different kinds of coal which may be burned may be materially changed by alteration of the draft conditions.

George I. Rockwood inquired about the maximum amount of coal which the fireman could throw on the grate. Locomotives were driven hard and the quantity of coal handled per man larger than in the case of stationary plants. Mr. Henderson in reply said that he had handled 4,000 lb. per hour but he had known of an instance where a fireman worked at the rate of 6,000 lb. per hour. This was of course an exceptional case and conditions very favorable. The train was standing on the track and the coal was weighed and taken direct to the fireman, who "was kept real busy."

Further discussion touched upon the possibility of working two firemen on a locomotive and the practicability of automatic stokers for the work. Mr. Henderson had seen an automatic stoker which threw 17,000 lb. per hour on the grate. In reply to an inquiry relative to the practicability of pulverized coal on locomotives, he said that he had made some experiments but the apparatus used would not supply the required amount of coal. Albert A. Cary thought that pulverized coal would acquire too much moisture on the tender. The pulverized coal required a very hot furnace for satisfactory combustion and to attain this end the coal must be burned almost explosively and this meant refractory linings. He was of opinion from these and other considerations that the prospects did not seem favorable for pulverized fuel on locomotives.

The paper by E. A. Hitchcock on "Road Tests of Brooks' Passenger Locomotives" was read in abstract and the two papers, as will be seen, gave rise to much joint discussion of mechanical matters pertaining to railroads.

Discharge of Water with Steam from Water Tube Boilers.

A. Bement submitted the above paper and also read another one dealing with more exact methods for determining the efficiency of steam generating apparatus. Both received much attention and during the discussion Henry H. Suplee reported that a number of experiments had been made in France on separators and that at a critical speed of the steam, determined for each separator, they had failed. He thought it would be a good plan if every manufacturer of separators would designate the critical speed of the steam for his product and then it could be employed under the most favorable conditions.

Albert A. Cary had had considerable to do with the Root boiler a number of years ago and described some jet and vortex peculiarities he had encountered. A curved neck joined the lower drum to the lower front end of the upper one and the steam was taken out at the rear of the upper drum. Water was carried over with the steam and he had taken an experimental boiler, attached water columns at various points along the drum and had ascertained that the jet from the front drove the water directly at the outlet at the opposite corner. He had remedied the trouble by placing the drum at an angle. He had also discovered a vortex action in the pipe leading down from the upper drum and had met this by the insertion of a wire cage at the top end of the pipe and thereby broke up the vortex. Comment was made upon the creeping of a film of water along surfaces, particularly in separators, and Mr. Cary was reminded of another experience with the Root boiler. He said the natural position of the dry pipe was with the inlet holes pointing upward but he had found less water passing over if the dry pipe had the holes downward, in the former case the water crept along the drum and the holes were near to the surface and caught the water. Some difference of opinion arose about the advisibility of changing the standard method of testing boilers. William Kent and D. S. Jacobus saw no necessity for making a change and did not welcome the adoption of the plan now proposed. On the other hand, Mr. Cary submitted a lengthy discussion treating of a boiler test and presented a heat balance sheet to demonstrate the advisability of separating the results from boiler and furnace respectively.

Forcing Capacity of Fire Tube Boilers.

F. W. Dean presented his paper which proposes to correct prevailing opinion upon the relative forcing capabilities of the two types of boiler. Mr. Dean submits that there is a widespread impression that the fire tube type of boiler has less capacity to be worked above its rated power than boilers of the water tube type and that it is necessary to provide such boilers with more heating surface per horsepower than water tube boilers require. Forcing may be considered in a general way as the capacity to evaporate much more water than the rated power of the boiler would demand. This amount is often from 20 to 100 percent in excess of the rated requirements and depends upon the quantity of fuel consumed in a unit of time. This in turn chiefly depends upon the draft in the fire box and the freedom with which the air can pass through the grate or stoker and through the fuel itself. Mr. Dean gives a table showing the water capacity ratio to the heating surface and from this it would appear that water tube boilers generally contain more water than horizontal fire tube boilers. The vertical water tube boiler as well as some designs of fire tube boilers, contains more water than horizontal boilers. The author asserts that the quantity of water contained by a boiler has no effect upon forcing capacity after the steam is once up to the working pressure. A number of boiler tests are given and various comments made upon combustion and steam raising conditions. The boilers of locomotives come in for brief but emphatic praise of their forcing capabilities and it is said to be common enough for a horsepower to be obtained from 2 sq. ft. of heating surface or even less and the horsepower per square foot of grate may vary from 20 to 40.

Prof. R. C. Carpenter considered the tests given in the paper to be individually and collectively valuable. Mr. Dean had stated that there is a widespread impression among many persons that the fire tube type of boiler has less capacity to be worked above its rated power than boilers of the water tube type and his tests are intended to show that such an impression is erroneous. Prof. Carpenter had been thrown in contact with a large number of persons interested in boilers and had never found that such an impression was in existence. He did not wish to detract from the value of the paper and was quite willing to admit that Mr. Dean had pounded his straw

man very hard but believed that the object of his paper should be changed since so far as the professor's experience goes the general impression held by interested people is that fire tube boilers are capable of being forced more than the water tube type.

A. H. Eldredge contributed the following: In determini g the kind of boiler to be used there are many questions to be considered, among which are the following: The pre sure to be carried. The size of boiler and thickness of shell. The probable time before the reduction of pressure by the insurance companies will put the boiler out of commission, or at least, out of range of economical usefulness. The forcing capacity of the boiler. The comparative safety of the different types of boilers. Reliability for continuous hard service. Size of the plant. These are all questions that the engineer dealing with plants from 500 to 5,000 horsepower or over must meet. Where should the fire tube boiler stop and the water tube begin? In dealing with some of the largest fire tube boiler companies during the past year they have quoted prices based on 14 sq. ft. of heating surface, and when in competition with the water tube builders they are willing to quote on 12 sq. ft. The writer has been unable to get the fire tube builders to guarantee either evaporation or repairs, but has found the water tube builders willing to do either. The burning of 21.4 lb. of coal per square foot of grate with .21-in. draft was an excellent performance. During the past summer the writer had one plant of 11 fire tube boilers averaging 150 horsepower each, and with .295-in. draft it was impossible to burn over 9¼ lb. of New river coal per square foot of grate as the average for 24 hours, the boilers being pushed for the 24 hours. In 1901, on a plant of nearly 3,000 horsepower of water tube boiler, the writer had 75 tests made to determine the comparative values of different western fuels. One boiler was fitted up with scales, tanks, pump, etc., for the work, and was handled exactly as the rest of the battery. In only three tests, with the poorest coals, did the boiler simply reach rated horsepower, while in most tests it ran from 25 to 60 percent over capacity, and in a few cases ran over 85 percent above rating. These boilers are now eight years old and have been pushed this way day and night with poor feed water, and are still carrying 150 lb. pressure, with every indication that they will continue to do so. Is there not a best place for each type of boiler?

Standards for Refrigerating Work.

A preliminary report of the committee appointed in Dec., 1903, to consider a standard tonnage basis for refrigeration showed that the committee had made no attempt to include other machines than those which perform refrigeration by evaporating a refrigerating fluid to a vapor. Working on this line, the committee has confined itself strictly to a thermal rating and to the establishment of a set of conditions which would seem to represent good average engineering practice. The subject was considered under two heads: *A.* The selection of units to measure the cooling effect or the refrigeration produced. *B.* The selection of a standard set of conditions under which a refrigerating machine, no matter what its type, shall be run in determining what is herein designated as its commercial tonnage capacity. The unit adopted to measure the cooling effect, or the refrigeration, is the heat required to melt one pound of ice, which is 144 British thermal units, and by dividing the refrigeration, measured in British thermal units, by 144, the ice melting capacity in pounds is obtained. The unit for a ton (2,000 lb.) of ice melting capacity is therefore 288,000 British thermal units. The committee feel that this tonnage unit cannot be improved upon, and recommend its adoption. The commercial tonnage capacity is the refrigerating effect, expressed in tons of ice melting capacity produced by a machine in 24 hours when running continuously under the standard set of conditions. The committee consisting of D. S. Jacobus, chairman; E. F. Miller, P. D. C. Ball, A. P. Trautwein and Gardner T. Voorhees, recommends that a committee be appointed to report, suggesting rules for the best methods of measuring the quantity of refrigerating fluid evaporated in the refrigerator, together with a code of rules for conducting tests of refrigerating machines or plants. William Kent proposed that the present committee be continued and asked to take up the work suggested in the recommendation of the report. The motion was adopted.

At the meeting of the society held in New York, Dec., 1901, a committee consisting of James B. Stanwood, chairman, W. M. McFarland, A. L. Rohrer, Frank Ball and W. B. Forbes, presented a report on certain questions connected with the standardization of engines and dynamos. Experience since the recommendations of this committee, has induced the members of that former committee to the belief that an improvement could be made by adding the following appendix: "To facilitate pressing the armature upon the engine shaft, the engine builder should reduce the diameter of the shaft beyond the armature fit an amount not less than six thousandths of an inch." The recommendation will be sent out with the report of the committee.

James M. Dodge gave some recollections of the bust of John Erickson. This was modeled by Sculptor Nieland for the pleasure of Prof. Mapes and himself, both warm friends of the celebrated engineer, and the likeness was considered an excellent one. Some members of the society felt that the plaster cast was liable to suffer injury and therefore had had the bust made in enduring bronze and it was then on exhibition.

President Swasey announced at this session the selection of Thomas A. Edison by the council as an honorary member. The president called upon the president elect and in response Mr. Freeman earnestly pledged his best service to the society and paid a tribute to the labors of his predecessor. Mr. Swasey thanked the members and officers who had aided him in the work he had undertaken and with these exchanges of good will and esteem the session closed.

Scranton, Pa., has been chosen as the place for the spring meeting of 1905.

Those in Attendance.

William S. Ackerman, Ackerman & Partridge, New York.
Geo. M. Basford, editor *American Engineer*, New York.
Louis Cassier, *Cassier's Magazine*, New York.
Henri G. Chatain, E. E., New York.
Albert Ladd Colby, International Nickel Co., New York.
William L. Dearborn, Eastwick Engineering Co., New York.
Lester G. French, editor *Machinery*, New York.
L. R. Hopton, Supt. Oxley-Enos Co., New York.
David L. Hough, consulting engineer and contractor, New York.
Charles Wallace Hunt, New York.
Frank E. Idell, consulting engineer, New York.
John C. Kafer, past asst. engineer U. S. N., New York.
D. S. Jacobus, Stevens Institute of Technology, Hoboken, N. J.
John W. Lieb Jr., New York Edison Co., New York.
Charles E. Lucke, Columbia University, New York.
E. D. Meier, Heine Steam Boiler Co., New York.
Henry C. Meyer Jr., consulting mechanical engineer, New York.
Fred J. Miller, editor *American Machinist*, New York.
William F. Monaghan, United Elec. Lt. & Power Co., New York.
Chas. R. Pratt, cons. engineer, New York.
William E. Quimby, William E. Quimby, inc., New York.
C. W. Rice, General Electric Co., New York.
Jesse M. Smith, mech. and elect. engineer, New York.
Richard H. Soule, consulting mechanical engineer, New York.
Albert Spies, editor *Electrical Age*., New York.
F. H. Stillman, Watson-Stillman Co., New York.
Henry H. Suplee, editor *Engineering Magazine*, New York.
Geo. N. Van Derhoef, Dodge Mfg. Co., New York.
Arthur L. Williston, Pratt Institute, New York.
Ira H. Woolson, Columbia University, New York.
Gus. C. Henning, consulting engineer, New York.
Chas. E. Billings, Billings & Spencer Co., Hartford, Conn.
John J. Hoppes, Hoppes Mfg. Co., Springfield, O.
F. L. Emory, West Va. University, Morgantown, W. Va.
A. H. Hiller, Carbondale Machine Co., Carbondale, Pa.
Chas. A. G. Winther, Chapman Valve Mfg. Co., Indian Orchard, Mass.
Henry Vogt, mechanical engineer, Louisville, Ky.
Sidney Hosmer, Edison Elect. Ill. Co. of Boston.
W. J. Keep, supt. Michigan Stove Works, Detroit, Mich.
William H. Honiss, Hartford, Conn.
W. R. Park, Hancock Inspirator Co., Taunton, Mass.
T. L. Rankin, Sacketts Harbor, N. Y.
Eugene Childs, Tremont Mfg. Co., Boston.
W. S. Huson, Whitlock Printing Press Mfg. Co., Derby, Conn.
Harrington Emerson, consulting engineer, Buffalo, N. Y.
W. L. Cheney, Meriden, Conn.
William Gleason, Gleason Tool Works, Rochester, N. Y.
Geo. M. Bond, Hartford, Conn.
H. L. Whittemore, Sullivan Machinery Co., Claremont, N. H.
Lewis H. Morgan, Ridgway, Pa.
Francis H. Richards, engineer, Hartford, Conn.

H. M. Norris, Bickford Drill & Tool Co., Cincinnati, O.
Franklin Phillips, Hewes & Phillips Iron Works, Newark, N. J.
F. B. Cowan, Chicago Pneumatic Tool Co., Franklin, Pa.
Axel Sahlin, 1 Arundel St., Strand, London.
C. J. H. Woodbury, American Tel. & Teleg. Co., Boston.
James Hartness, Jones & Lamson Machinery Co., Springfield, Vt.
Maxwell M. Upson, Westinghouse, Church, Kerr & Co., New York.
Paul E. Schneider, New York.
S. D. Tompkins, Smooth-On Mfg. Co., Jersey City, N. J.
Jas. L. Ayer, Simplex Electrical Co., Boston.
John W. Loveland, patent attorney, New York.
W. S. Rogers, Bantam Mfg. Co., Bantam, Conn.
Austin Lord Bowman, consulting engineer, New York.
Geo. H. Barrus, cons. steam engineer, Boston.
E. R. Archer, chief engineer Tredegar Co., Richmond, Va.
M. F. Moore, Roselle, N. J.
David H. Ray, New York.
A. B. Steen, National Transit Co., Oil City, Pa.
Joseph C. Schaeffier, Somerville, Mass.
William W. Estes, Cacheco Mfg. Co., Providence, R. I.
L. N. Sullivan, Lehigh University, Bethlehem, Pa.
E. O. Spillman, Herschell, Spillman & Co., N. Tonawanda, N. Y.
Gardner T. Voorhees, refrig. eng., Boston.
John Platt, prest. Thorpe, Platt & Co., New York.
J. K. Wright, consulting engineer and manufacturer, New York.
C. M. Russell, Massillon, O.
F. M. Rites, Ithaca, N. Y.
Percy A. Sanguinetti, consulting engineer, New York.
R. S. Kent, Arbuckle Bros., Brooklyn, N. Y.
D. A. Wightman, Warren, R. I.
Geo. I. Rockwood, Worcester, Mass.
W. O. Platt, Jos. Reed Gas. Engine Co., Oil City, Pa.
Alex. R. Goldie, Goldie & McCullock, Galt, Ont.
Harold B. Atkins, consulting engineer, Roselle, N. J.
Harris Tabor, Elizabeth, N. J.
Henry J. Eberhardt, Gould & Eberhardt, Newark, N. J.
Frank E. Eberhardt, Gould & Eberhardt, Newark, N. J.
Elmer J. Eberhardt, Newark, N. J.
H. L. Duerner, supt., Rochester, N. Y.
Chas. H. Corbett, Continental Iron Works, Brooklyn, N. Y.
F. V. Henshaw, Crocker-Wheeler Co., New York.
E. Graves, supt. Camden Iron Works, Camden, N. J.
W. P. Valentine, Westfield, N. J.
A. Faber Du-Faur, consulting engineer, Newark, N. J.
Frederick F. Schuetz, Columbia University, Newark, N. J.
A. Bement, Chicago.
Jas. M. Dodge, P. Link-Belt Engineering Co., Nicetown, Philadelphia.
Chas. W. Naylor, Chicago.
Henry M. Lane, editor *The Foundry*, Cleveland, O.
Wm. Wallace Christie, consulting engineer, Paterson, N. J.
J. B. Francis Herreshoff, prest. Herreshoff Mfg. Co., New York.
Edward F. Miller, Mass. Inst. of Technology, Newton Centre, Mass.
J. Lawrence Hagy, Electrical Storage Battery Co., Tioga, Philadelphia.
Alex. Miller, Alex. Miller Bros., New York.
A. L. Burns, New York.
William T. Donnelly, Faber du Faur & Donnelly, New York.
Frederick Meriam Wheeler, Geo. F. Blake Mfg. Co., Montclair, N. J.
Judson H. Boughton, asst. chief engineer, New York.
H. L. Gantt, consulting engineer, Providence, R. I.
Frederick L. Scheffler, Marine Engine & Machine Co., Harrison, N. J.
S. T. Wellman, Wellman-Seaver-Morgan Co., Cleveland, O.
H. De B. Parsons, consulting engineer, New York.
Sam H. Libby, Sprague Elect. Co., Bloomfield, N. J.
D. G. Moore, Elizabeth, N. J.
Edgar Penney, Newburgh Ice Mach. & Eng. Co., Newburgh, N. Y.
John J. Swan, prest. Longmead Iron Co., Conshohocken, Pa.
W. M. Allen, Cleveland, O.
Alex. Dow, gen. mgr. Edison Ill. Co., Detroit, Mich.
Albert W. Jacoby, Gould & Eberhardt, Newark, N. J.
Robt. McArthur, Pepperell Mfg. Co., Biddeford, Me.
T. R. Almond, Dunwoodie Heights, Yonkers, N. Y.
A. W. Cash, The Fairbanks Co., New York.
Fred H. Colvin, The Derry-Collard Co., New York.
G. L. H. Arnold, Stamford, Conn.
Louis E. Eden, Brooklyn, N. Y.
E. H. Powell, International Text Book Co., Scranton, Pa.
Elmer H. Neff, Brown & Sharpe Mfg. Co., Providence, R. I.
W. B. Bogardus, Peninsular Eng. & Const. Co., Jackson, Mich.
A. M. Feldman, consulting engineer, New York.
Chas. F. Smith, Milliken Bros., New York.
James W. Gillette, Phoenixville, Pa.
Theodore N. Case, M. E., Cons. Gas Co., Mount Vernon, N. Y.
E. W. Thompson, Southern Cotton Oil Co., New York.
G. A. Buvinger, Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
John H. Norris, Roselle, N. J.
John Turner, American Bank Note Co., New York.
F. A. Halsey, assoc. editor *American Machinist*, New York.
H. P. Fairfield, Worcester Polytechnic Institute, Worcester, Mass.
Alton L. Smith, Worcester, Mass.
G. A. Gulowsen, draftsman, Huguenot, S. I.
George Dinkel, American Sugar Refining Co., Jersey City, N. J.
Wm. E. Crane, M. E., Waterbury, Conn.
P. Muller, Sprague Electric Co., Bloomfield, N. J.
W. S. Morehouse, Cameron Steam Pump Works, New York.
W. A. Viell, Brown & Sharpe Mfg. Co., Providence, R. I.
Edward F. Schnuck, Arbuckle Bros., New York.
Fred C. Fladd, E. W. Bliss Co., Brooklyn, N. Y.
James G. Winship, International Steam Pump Co., New York.
Wm. D. Stivers, Jersey City, N. J.
Fred Brotherhood, M. E., New York.
H. W. Rice, Orange, N. J.
Bartholomew Viola, Chas. Pfizer & Co., New York.
Frank J. Wood, Marx & Rawolle's Glycerine Factory, Brooklyn, N. Y.
Nils O. Lindstrom, A. B. See Electric Elevator Co., Brooklyn, N. Y.
Henry Marx, Cincinnati, O.
H. F. Frevert, Niles Tool Works Co., New York.
Fred Nolde, Penn. Iron Works Co., Philadelphia.
Harry E. Smith, L. S. & M. S. Railway Co., Collinwood, O.
Francis X. McGowan, Western Electric Co., New York.
Fred E. Matthews, New York.
Franklin Williams, New York.
J. G. Lepper, supt. Fastener Mfg. & Mach. Co., Hoboken, N. J.
C. H. Baker, Westinghouse, Church, Kerr & Co., New York.
John T. Horton, Brooklyn, N. Y.
G. R. Henderson, New York.
R. B. Hartness, Fairbanks Co., New York.
A. R. Foot, New York.
Fred B. Corey, M. E., General Electric Co., Schenectady, N. Y.
Geo. B. Orrok, Edison Co., New York.
E. W. Marshall, New York.
Samuel S. Webber, manager, Trenton Iron Co., Trenton, N. J.
H. D. Gordon, M. E., Jenkins Bros., East Orange, N. J.
W. H. Morse, engineer, Power & Mining Machinery Co., New York.
C. Ducas, associate editor, *Railroad Gazette*, New York.
G. R. Henderson, New York.
Francis A. Powell, Philadelphia.
Seaton M. Scott, Brooklyn, N. Y.
Arthur M. Waitt, Yonkers, N. Y.
Emile H. Nate, Newark, N. J.
Harry H. Slawson, Passaic, N. J.
J. F. Wilson, Wilson & Smith, Worcester, Mass.
Geo. H. Smith, Beaman & Smith Co., Worcester, Mass.
E. H. Sedgwick, Babcock & Wilcox Co., Elizabeth, N. J.
A. C. Smith, Otis Elevator Co., Yonkers, N. Y.
William Fox, College of City of New York.
Edwin M. Coryell, supt. Cameron Steam Pump Works, New York.
Frederick A. Goetze, Columbia University, New York.
Henry Lee Norris, New York.
A. L. Goddard, C. W. Hunt Co., New York.
A. B. Moore, Crane Co., Bridgeport, Conn.
W. V. Gould, Jones & Lamson, Springfield, Vt.
Ed. A. Uehling, Passaic, N. J.
Earnest T. Child, B. F. Sturtevant Co., Jamaica Plain, Mass.
A. Riesenberger, Stevens Institute, Hoboken, N. J.
Fred W. Taylor, consulting engineer, Philadelhpia.
H. F. Glenn, M. E., Berwick, Pa.
Carl G. Barth, consulting engineer, Swarthmore, Pa.
W. W. Nichols, Baltimore Copper Works, Baltimore, Md.
James P. Tolman, Samson Cordage Works, Boston.
Herschmann, Adams Express Co., New York.
Wm. B. Cogswell, Solvay Process Co., Syracuse, N. Y.
Darwin Almy, Almy Water Tube Boiler Co., Providence, R. I.
W. F. Hunt, C. W. Hunt Co., New York.
James V. V. Colwell, West New Brighton, N. Y.
A. B. Cummings, See Electric Elevator Co., New York.
J. T. Taylor, New York.
Chas. E. Ross, engineer Morgan Iron Works, New York.
John Fritz, Bethlehem, Pa.
Leland H. Lowe, asst. editor *Cassier's Magazine*, New York.
J. A. Almirall, Brooklyn, N. Y.
C. F. Dixon, Mangelsdorff, Dixon & Brower, New York.
A. L. Rohrer, General Electric Co., Schenectady, N. Y.
E. P. Bates, mfg. heating apparatus, Syracuse, N. Y.
C. W. Obert, Brooklyn, N. Y.
W. J. Kaup, Pratt Institute, Brooklyn, N. Y.
W. E. Hussey, New York.
E. L. Hayward, Pratt Institute, New York.
Chas. W. Barnaby, M. E., New York.
Arthur J. Frith, Secy Washington Co., New York.
D. L. Holbrook, Otis Elevator Co., Yonkers, N. Y.
Orosco Woolson, Newark, N. J.
Geo. A. Tibbals, Continental Iron Works, Brooklyn, N. Y.
Oliver S. Shantz, Rand Drill Co., New York.
Robert MacArthur Jr., New Haven, Conn.
Wm. A. Morse, Otis Elevator Co., Yonkers, N. Y.
Dwight S. Cole, Brooklyn, N. Y.
F. W. Midgley, Yonkers, N. Y.
Ernest Gamon, Long Island City, N. Y.
M. W. Sewall, Babcock & Wilcox Co., New York.
Chas. Dunn, R. W. Hunt & Co., New York.
C. E. Houghton, New York University, New York.
C. R. Cullingworth, New York.
Philip E. Raque, Jersey City, N. J.
Louis R. Alberger, Alberger Condenser Co., New York.
Alfred Williamson, N. Y. C. & H. R. R. R., W. Albany, N. Y.
John Macphie, Montclair, N. Y.
R. C. McKinney, Niles-Bement-Pond Co., New York.
Pierson M. Neave, Western Electric Co., New York.
T. M. Phetteplace, Providence, R. I.
Wm. H. Boehm, Fidelity & Casualty Co., New York.
Victor J. Goetz, De La Vergne Refrigerating Machine Co., New York.
Stephen W. Baldwin, Pennsylvania Steel Co., New York.
Harvey E. Newell, India Rub. & Gutta Percha Ins. Co., Yonkers, N. Y.
Peter Ehlers, Philadelphia.
Chas. B. Rowland, Continental Iron Works, Brooklyn, N. Y.
Chas. B. Rearick, D'Olier Engineering Co., New York.
John E. Sweet, Straight Line Engine Co., Syracuse, N. Y.
Amasa Trowbridge, Columbia University, New York.
Kenneth Torrance, Ridgewood Pumping Station, Brooklyn, N. Y.
A. W. Patterson Jr., M. E., New York.
F. E. Holt, Singer Mfg. Co., Elizabeth, N. J.
Fred M. Hitchcock, Rand Drill Co., New York.
Alfred P. Trautwein, president, Carbondale Mach. Co., Carbondale, Pa.
F. R. Low, editor *Power*, New York.
E. W. Davenport, superintendent, Brighton Mills, Passaic, N. J.
S. S. Jordan, New York.
Eugene W. Rutherford, Brooklyn, N. Y.
George H. Waters, West New Brighton, N. Y.
Harry G. Harrington, New Jersey Zinc Co., New York.
G. E. Merryweather, Cleveland, O.
John W. Young, New York.
D. J. Lewis Jr., Cons. Engr., South Orange, N. J.
A. T. Nickerson Jr., Westinghouse, Church, Kerr & Co., New York.
H. Conrad, chief engineer, Rand Drill Co., New York.
W. A. Jordan, West Brighton, S. I., N. Y.
Daniel H. Jones, Ampere, N. J.
N. H. Doane, Cincinnati, O.
W. H. Diefendorf, Syracuse, N. Y.
W. D. Steele, Westinghouse, Church, Kerr & Co., New York.
R. Raymond, Brooklyn, N. Y.
Fred A. Phelps, M. E., Newark, N. J.
Geo. G. Bennett, Sullivan Machinery Co., Claremont, N. H.
Francis H. Boyer, M. E., Somerville, Mass.
Geo. I. Bouton, engineer, Heine Safety Boiler Co., New York.
T. A. Bennett, Robins Conveying Belt Co., New York.
L. W. Cole, Eagle Square Mfg. Co., S. Shaftbury, Vt.
A. N. Abbott, New York.
Frank Richards, assoc. editor, *American Machinist*, New York.
James Craig Jr., Van Cortland Park, N. Y.
J. J. Chisholm, New York.
Thomas Helton Williams, A. A. Griffing Iron Co., Jersey City, N. J.
Wm. T. Bonner, Wm. T. Bonner & Co., Boston.
Chas. L. Huston, Lukens Iron & Steel Co., Coatesville, Pa.
Collins P. Bliss, prof. mechanical engineering, New York University.
Arthur J. Slade, New York.
Daniel A. Mason, consulting engineer, Mason & Sloane, New York.
B. F. Stangland, Howard & Morse, New York.
O. N. Evans, steam heating engineer, New York.

W. W. Macon, assoc. editor *Engineering Record*, New York.
H. R. Cobleigh, assoc. editor *Iron Age*, New York.
John L. Gill, M. E., New York.
John J. Connell, Tremont & Suffolk Mills, Lowell, Mass.
J. A. Vail, New Rochelle, N. Y.
Seth Wheeler, New York.
William W. Reid, Worcester, Mass.
Albert A. Cary, consulting engineer, New York.
T. Allen Hilles, Hilles & Jones Co., Wilmington, Del.
J. E. Johnson Jr., Longdale Iron Co., Longdale, Va.
J. R. Vanhorne, Jersey City, N. J.
John D. Logan, Logan Iron Works, Brooklyn, N. Y.
John W. Logan, Logan Mfg. Co., Phoenixville, Pa.
Geo. T. Gwilliam, civil engineer, Union League, Philadelphia.
R. Campbell Cairncross, New York.
Martin L. Katzenstein, International Steam Pump Co., New York.
Carl L. Grohmann, Mergenthaler Linotype Co., Brooklyn, N. Y.
James W. Nelson, Brooklyn, N. Y.
T. W. Fry, Claremont, N. H.
R. S. Hale, Mutual Boiler Insurance Co., Boston.
George M. Brill, cons, elec'l. and mech'l eng., Chicago.
William W. Nichols, Baltimore Copper Works, Baltimore, Md.
Z. M. Briggs, Philadelphia.
J. Waldo Smith, supt. Passaic Water Co., Paterson, N. J.
W. A. Pearson, General Electric Co., Schenectady, N. Y.
Frank B. Perry, General Electric Co., Boston.
Chas. B. Burleigh, Malden, Mass.
F. A. C. Perrine, Pittsfield, Mass.
George E. Fisher, Natick, Mass.
R. E. Curtis, Edison Electric Illum. Co., Boston.
Wm. H. Kenerson, Providence, R. I.
Frank D. Holbrook, Wheeling, W. Va.
J. A. Capp, General Electric Co., Schenectady, N. Y.
Frank Mossberg, Frank Mossberg Co., Attleboro, Mass.
Paul H. Grimm, consulting engineer, Glen Cove, L. I.
Wm. M. Taylor, president, Chandler & Taylor Co., Indianapolis, Ind.
R. O. Norris, Wilkesbarre, Pa.
Edward N. Trump, Solvay Process Co., Syracuse, N. Y.
John A. McGregor, supt. Morse Twist Drill Machine Co., New Bedford, Mass.
Ira N. Hollis, Harvard University, Cambridge, Mass.
Chas. H. Manning, supt. Amoskeag Mfg. Co., Manchester, N. H.
Geo. C. Teuksbury, Boston.
William T. English, Boston.
Edward F. Hughes, Chapman Valve Co., Boston.
Jesse F. Stevens, Keystone Electric Instrument Co., Philadelphia.
Charles D. Montague, Cold Spring, N. Y.
M. P. Higgins, Norton Emery Wheel Co., Worcester, Mass.
Geo. I. Alden, Norton Emery Wheel Co., Worcester, Mass.
Robert S. Brown, New Britain Machine Co., New Britain, Conn.
Walter H. Hart, New Britain, Conn.
Ernest Lee Jahncke, New Orleans, La.
L. Moulthrop, New Haven Mfg. Co., New Haven, Conn.
E. Rivett, Boston.
Howard L. Coburn, Lockwood Greene & Co., Boston.
Edward J. Smith, Portland, Me.
Giles Beach, Gloversville, N. Y.
J. A. White, Lackawanna Steel Co., Buffalo, N. Y.
Frederick A. Hannah, Crosby Steam Gauge & Valve Co., Boston.
Lewis H. Nash, National Meter Co., Brooklyn, N. Y.
W. R. Wilson, Wheeler Condenser & Eng. Co., New York.
Charles R. Bishop, American Dist. Steam Co., Lockport, N. Y.
S. F. Bagg, Watertown Engine Co., Watertown, N. Y.
A. C. Walworth, Walworth Const. & Sup. Co., Newton Centre, Mass.
Edgar C. Wiley, designing engineer, Lynchburg, Va.
J. S. Detrick, Detrick & Harvey Machine Co., Baltimore, Md.
Clement W. Botchford, Phoenicia, N. Y.
Wm. H. Gerrish, Dolphin Jute Mills, Paterson, N. J.
Herbert Gray Torrey, U. S. Assay Office, New York.
G. W. Smith, New York.
M. M. Green, Detroit, Mich.
G. H. Lilley, M. M., A. B. & C. Co., Wire Mill, Ansonia, Conn.
C. H. Buckley, Philadelphia.
Geo. H. Stegman, W. E Baker & Co., New York.
Chas. L. Clarke, patent expert, New York.
Lyman L. Merriam, Lyon Falls, N. Y.
H. M. Marble, patent solicitor, Newark, N. J.
D. Howard Haywood, Chapin, Haywood & Marble, New York.
E. R. Baylor, Junction, N. J.
John A. Serrell, New York.
C. H. Wheeler, Wheeler Condenser & Eng. Co., New York.
Robert E. Hall, sec'y New York Steam Fitting Co., New York.
George S. Humphrey, coptroller, C. W. Hunt Co., New York.
Edward Van Winkle, Jersey City, N. J.
Geo. E. Greenleaf, Pond Machine Tool Co., Plainfield, N. J.
Raoul Hellmer, Elizabeth, N. J.
Henry D. Hibbard, Manganese Steel Safe Co., New York.
Wm. F. Zimmermann, New York.
D. A. Wightman, Jersey City, N. J.
W. H. O fell, Yonkers, N. Y.
T. C. Sc uyler, Brooklyn, N. Y.
Chas. T. Main, Boston.
Chas. R. Main, Boston.
Ephriam Smith, Colonial Steel Co., New York.
O. K. Ca n, Hoboken, N. J.
Wm. H. Bristol, Stevens Institute, Hoboken, N. J.
F. A. Hall, Yale & Towne Mfg. Co., New York.
Thomas C. Perkins, T. C. Perkins Co., Hartford, Conn.
Sterling H. Bunnell, Watertown Engine Co., Watertown, N. Y.
R. P. Bolton, New York.
E. H. Foster, M. E., New York.
James Brady, consulting engineering, Brooklyn, N. Y.
Geo. R. Stetson, New Bedford Gas & Edison Light Co., New Bedford, Mass.
Francis Hodgkinson, Westinghouse Machine Co., East Pittsburg, Pa.
Samuel N. Braman, Westinghouse, Church, Kerr & Co., Boston.
Chas. H. Little, Universal Drafting Machine Co., Cleveland, O.
Robert I. Clegg, editor machinery dept. *The Iron Trade Review*, Cleveland, O.
L. S. Louer, Western manager *Engineering Record*, Chicago.
S. W. Dudley, New Haven, Conn.
Fred D. Holdsworth, Claremont, N. H.
F. J. Bryant, Passaic, N. J.
Harry Alexander, Elect'l. and Mech'l. Eng., New York.
Wm. H. Baush, Springfield, Mass.
Carelton W. Nason, prest. Nason Mfg. Co., New York.
David Townsend, M. E., Philadelphia.
E. R. Fellows, Fellows Gear Shaper Co., Springfield, Vt.
Geo. B. Caldwell, Westinghouse, Church, Kerr & Co., Yonkers, N. Y.
Harry P. Barr, East Orange, N. J.
H. M. Sage, Chicago.
Jas. E. Greensmith, gen. supt. Mason Machine Works, Taunton, Mass.
Geo. E. Whitehead, supt. R. I. Tool Co., Providence, R. I.
Will J. Sando, International Steam Pump Co., New York.
William Gregory, Brooklyn, N. Y.
Henry P. Merriam, New York.
E. S. Barlow, International Steam Pump Co., New York.
H. G. Reist, General Electric Co., Schenectady, N. Y.
Geo. M. Peck, Pelton Water Wheel Co., New York.
Fred L. Eberhardt, Gould & Eberhardt, Newark, N. J.
P. Howard Troth, Fairbanks Co., New York.
A. M. Mattice, Westinghouse Machine Co., East Pittsburg, Pa.
B. H. Warren, New York.
Henry Torrance Jr., engineer, New York.
Geo. J. Foran, International Steam Pump Co., New York.
A. D. Finley, Russell, Burdsall & Ward, B. & N. Co., Port Chester, N. Y.
Knight C. Richmond, M. E., Providence, R. I.
Wm. O. Webber, Brookline, Mass.
Walter B. Snow, M. E., B. F. Sturtevant Co., Jamaica Plain, Mass.
L. D. Burlingame, chief draftsman, Brown & Sharpe Mfg. Co., Providence, R. I.
W. O. Mundy, master mechanic, St. Louis Transit Co., St. Louis.
Richard H. Rice, Providence Engineering Works, Providence, R. I.
A. H. Eldredge, consulting engineer, Swift & Co., Boston.
S. E. Dauchy, draftsman, Yale & Towne Mfg. Co., Stamford, Conn.
Chas. Z Newell, Yonkers, N. Y.
W. A. Shundy, Hoboken, N. J.
W. D. Hoxie, engineer, Westinghouse, Church, Kerr & Co., New York.
Chas. K. Stearns, M. and E. E., Boston.
W. B. Mayo, manager Hooven, Owens, Rentschler Co., New York.
J. H. Abercrombie, Clark Thread Co., Newark, N. J.
C. H. Weeks, Buckeye Engine Co., Salem, O.
J. Wendell Cole, Detroit Emery Wheel Co., Columbus, O.
Paul B. Morgan, Morgan Construction Co., Worcester, Mass.
James B. Ladd, consulting engineer, Philadelphia.
S. K. Thompson, master mechanic, Stanley G. Flagg & Co., Philadelphia.
Adam De Trampe, Philadelphia.
E. S. Farwell, consulting engineer, Ridgewood, N. J.
John H. Kelman, Brooklyn, N. Y.
John Calder, manager, Wyckoff, Seamans & Benedict, Ilion, N. Y.
F. L. Pryor, Stevens Institute, Hoboken, N. J.
C. M. Allen, Worcester Polytechnic Institute, Worcester, Mass.
A. P. Boller Jr., Westinghouse Machine Co., New York.
Geo. O. Gridley, supt. Windsor Machine Works, Windsor, Vt.
F. H. Ball, vice president, American Engine Co., Plainfield, N. J.
Edward G. Budd, engineer, Hale & Kilburn Mfg. Co., Philadelphia.
Geo. Mesta, president, Mesta Machine Co., Pittsburg, Pa.
Samuel M. Green, mechanical superintendent, Merrick Thread Co., Holyoke, Mass.
Wm. A. Bole, supt., Westinghouse Machine Co., E. Pittsburg, Pa.
John Dick, Pheonix Iron Works Co., Meadville, Pa.
Geo. F. Stillman, Syracuse, N. Y.
Geo. E. Camp, Utica, N. Y.
W. E. Schoenborn, solictor of patents, Washington, D. C.
Ward S. Jacobs, mech. eng. Phoenix Iron Works Corporation, Hartford, Conn.
Thos. M. Eynon, Eynon-Evans Mfg. Co., Philadelphia.
F. O. Ball, American Engine Co., Plainfield, N. J.
H. M. Lucas, Lucas Machine Tool Co., Cleveland, O.
S. G. Colt, M. E., Stanley Electric Mfg. Co., Pittsfield, Mass.
John P. Coghlin, Page Electric Co., Worcester, Mass.
Alberto de Verastegui, manager, Babcock & Wilcox Co., New York.
Wm. L. Simpson, M. E., Philadelphia.
H. L. Aldrich, prop. *Marine Engineering*, New York.
E. J. Armstrong, supt. Ball Engine Co., Erie, Pa.
Irving McC. Bean, editor *Science and Industry*, Scranton, Pa.
Thos. H. Mirkil Jr., supt Southwark F. & M. Co., Philadelphia.
Orla K. Harlan, Scranton, Pa.
J. H. Pennington, supt., M. P., Del. S. & S. Ry., Drifton, Pa.
Max H. Miner, resident editor *Railway Age*, New York.
Frederick D. Herbert, editor *Marine Engineering*, New York.
John J. Mullaney, president Ideal Opening Die Co., New York.
John H. Barr, factory manager Smith Premier Typewriter Co., Syracuse, N. Y.
J. J. Brown, general sales manager, H. R. Worthington, New York.
Oscar E. Perrigo, New Haven, Conn.
Alex. F. Brown, mechanical expert, Smith Premier Typewriter Co., Syracuse, N. Y.
Otto W. Schaum, manufacturer of machinery, Philadelphia.
H. P. Townsend, New Britain, Conn.
F. J. Cole, assistant M. E., American Locomotive Co., Schenectady, N. Y.
E. F. Morse, Morse Thermo Gage Co., Trumansburg, N. Y.
Henry W. Bulkley, M. E., New York.
Konrad Meier, New York.
A. Wood, chief draftsman, Bement Miles Co., Philadelphia.
Wm. H. Derbyshire, Chambersburg Engineering Co., Chambersburg, Pa.
H. O. Pond, Tenafly, N. J.
Gustave Hillman, naval architect, Brooklyn, N. Y.
H. B. Roelker, M. E., New York.
H. S. Brooks, New York.
Wm. H. Deming, M. E., Continental Iron Works, Brooklyn, N. Y.
John K. Murphy, New Haven, Conn.
C. T. Rafferty, New York.
Randolph T. Olde, Providence Engineering Works, Providence, R. I.
S. A. Hand, supt. Chandler & Price Co., Cleveland, O.
Marcus Powell, manager sales department, Crosby Steam Gauge Co., New York.
F. H. Robinson, Walter H. Foster, New York.
Wm. Darbee, general superintendent, Conn. Ry. & Lighting Co., Bridgeport, Conn.

The Trenton Hardware Mfg. Co., successor to the Emmons-Borden Foundry & Machine Co., whose plant was destroyed by fire Nov. 13, expects to buy or lease a plant which will be suitable for its purposes, rather than to build at this season of the year, as it is not able to build and finish a new structure as quickly as it desires. The business of the company has been rapidly increasing and it is anxious to obtain a plant as soon as possible.

TESTS OF HIGH-SPEED TOOL STEELS AT ST. LOUIS.

Recent inquiries indicate that the result of the tests made on high-speed steel at the St. Louis Exposition is a matter of continued interest and the following data from the official report submitted to the Bureau of Awards will be a useful addition to the accounts already given in *The Iron Trade Review*. The tabulated report of the tests, as pointed out by one of the judges, is not altogether conclusive or satisfactory, owing to the fact that many of the leading crucible steel makers withdrew from the contest after apparently agreeing to all the conditions.

All the tests were made on a 12½-in. diameter rough steel casting furnished by the American Steel Foundry Co. This casting shows the following analysis: Carbon, 26 percent; manganese, 69 percent; phosphorus, .032 percent; silicon, .304 percent; sulphur, .022 percent. A 30-in. Putnam lathe was employed, operated by F. B. Smith, of the Hendey Machine Co., and driven by a Northern Electric Co.'s motor at 600 to 1,200 r. p. m. All of the tools were ground with 8-degree rake, 8-degree shear and 6-degree clearance, upon a William Sellers & Co.'s No. 1 universal tool grinder and shaping machine, equipped with a carborundum wheel. The summary of the tests and conditions shown in the accompanying table led to the following awards by the judges: McInnis extra, manufactured by the McInnis Steel Co., of Corry, Pa., first; Allen's air hardening steel, manufactured by Edgar Allen & Co., of Sheffield, Eng., second; Victoria high speed steel, manufactured by Richard Lindenberg & Son, of Germany, third.

OFFICIAL REPORT OF THE JUDGES OF HIGH SPEED TOOL STEEL TESTS AT WORLD'S FAIR ON SEPTEMBER 12, 13 AND 14, 1904.

Name of Tool	Forged or Holder	Size of Tool	Surface Speed Ft. per Minute	Feed per Revolution Inches	Depth of Cut	Duration of Cut		Length of Cut	Weight of Material Removed		Current Required for Cut Amperes	Comparative Condition of Tool	Horse Power Required for Cut
						Min.	Sec.		Lbs.	Oz.			
McInnis	Forged	2¼ x 2¼	100	9/64″	¼″	1	30	3 5/16″	11	4	102	1st	30.08
"	Armstrong Holder	1 x 1	100	9/64″	¼″		10	3/16″		8	75	3rd	22.12
"	Forged	2¼ x 2¼	75	3/32″	¼″	1	55	2 11/16″	10	10	65	1st	19.17
Allen	Forged	2¼ x 2¼	100	9/64″	¼″	1	30½	3″	10	15	97	3rd	28.61
"	Armstrong Holder	1 x 1	100	9/64″	¼″		20	5/8″	1	15	80	1st	23.59
"	Forged	2¼ x 2¼	75	3/32″	¼″	1	32	1¼″	4	7	.....	2nd	.....
Victoria	Forged	2¼ x 2¼	100	9/64″	¼″		50	2 3/16″	6	15	110	2nd	32.44
"	Armstrong Holder	1 x 1	100	9/64″	¼″		15	7/16″	1	10	101	2nd	29.78
"	Forged	2¼ x 2¼	75	3/32″	¼″		23	½″	1	8	.....	3rd	.....

Charles M. Schwab continues to take an optimistic view of the iron and steel situation. He said a few days ago: "So far as the iron and steel industry is concerned, the outlook is exceptionally bright. The earnings of the United States Steel Corporation, as well as independent concerns, will be very satisfactory in 1905. I would not be surprised if the output in 1905 exceeded all previous years. Two or three years ago I estimated the valuation of the iron ore of the United States Steel Corporation in sight at $1 a ton. If I were called upon to make another statement I would certainly raise my estimate. Iron ore is becoming more valuable every year."

The Reading Foundry Co. Reading, Pa., has filed an answer to the application for the appointment of a receiver, contending that the company is solvent and charging that the plaintiff, Albert H. Mellert, superintendent of the plant until recently was so inactive and neglectful of his duties that during the past year 60 percent of the pipe manufactured under his superintendency was rejected and returned to the company. It is also charged that Peter D. Wanner, and the plaintiff, by unwarranted and unjust criticisms of the company and its management, hampered it.

EASTERN PENNSYLVANIA.

HARRISBURG, Pa., Dec. 13.—Conditions in this section are improving and although the mills are not reopening as fast as in some parts of the country, there is a promise of continued work. The shipments lately have been large and already there are sharp demands for cars to handle products of concerns which are clearing out what was on hand.

The Pennsylvania Steel Co. has ordered its Steelton rail mill started up. The rest of the company's plant at Steelton is running, the bridge shop being engaged on New York City contracts and railroad work.

The property of the Logan Iron & Steel Co. was sold at Phœnixville for $50,250, subject to a mortgage of $50,000 There is some talk of starting up again.

Water shortage is worrying many concerns in the central and northern parts of the State and in some cities the conditions are serious. Altoona is the worst off as the large reservoir has sprung a leak and the shops of the Pennsylvania Railroad and the industries of the town are hampered. Milton, Sunbury and more northern places also suffer from low water.

The old Shimer foundry at Bethlehem has been secured by a Philadelphia group which will manufacture automobiles.

W. Harry Shetron has succeeded J. P. Luce as general manager of the Lalance & Grosjean Co.'s tin plate works in this city. Mr. Shetron has been connected with the plant for a long time. Mr. Luce has leased the old Bay foundry in this city and will operate it.

The Harrisburg Pipe & Pipe Bending Co. has started its new rolling mill. The Central Iron & Steel Co. may start another open-hearth furnace early in the new year.

Marshall furnace, at Newport, is working again.

This county has all of its works in operation. The last idle furnace will be started next month by the Pennsylvania Steel Co. and there are signs of activity in the Lebanon district, which has felt the depression severely.

The Duncannon Iron Co. will start its new puddle mill about the first of the year.

One of the furnaces at Rock Hill, Huntingdon county, which has been idle for a long time, is to be started.

The Eyre Construction Co. has been awarded the contract at $16,000 for the new State bridge at Catawissa. There were 32 bidders. Several bridges are to be given out in December.

The Bryden Horse Shoe Co. will enlarge its plant at Catasauqua.

Wistar & Co. will start their rolling mill at Bristol in about a month. It has been idle for a long time.

Vice President J. B. Carter, of the Pittsburg & Lake Erie railroad, announces that the line will be completed from Lorain to Youngstown next year. Steel has been bought and tracklaying will begin in March.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:—

The Isthmian Canal Commission will receive bids up to Jan. 6 for garbage cans, shovels, picks and hardware supplies. For further particulars, address the Isthmian Canal Commission, Washington, D. C.

The Mannen & Esterly Co. Cleveland, has been incorporated with a capital of $50,000, to deal in sheet metal goods. Incorporators are: John E. Mannen, Willis M. Esterly and others. The company succeeds the firm of Mannen & Esterly, 811 St. Clair street.

The Gulf City Boiler Works, Mobile, Ala., have been incorporated with a capital of $25,000. Incorporators are: W. M. Evans, W. T. Hieronymus and S. A. Ceviot.

The Southwestern Machine & Supply Co., Oklahoma City, Okla., has been incorporated with a capital of $50,000. Incorporators are: James A. Lobin, Katherine Lobin, Mamie Gibbons, James Gibbons and L. J. Hamilton.

The Eccentric Pump Co., Battle Creek, Mich., has been incorporated with a capital of $25,000 to make and sell pumps and windmills. The stockholders are: William C. Buck, Peterborough, Ont.; Frank E. Towne, Jackson; Nelson Toland and Frank J. Buck, Battle Creek.

The A. L. Granger Machine Co., Milwaukee, has been incorporated with a capital of $25,000. The incorporators are: A. L. Granger, Edward T. Fairchild and F. J. Knoell.

The Lunt Vise & Tool Co., Chicago, has been incorporated with a capital of $5,000 to manufacture tools and supplies. The incorporators are: J. L. McKittrick, George G. Standart and H. C. Ellis.

Fires and Accidents:—

The Pinneo & Daniels wheel manufactory, First and Madison streets, Dayton, O., was damaged by fire to the extent of $8,000 Dec. 2.

The plant of the Michigan Heater Co., Big Rapids, Mich., was visited by fire a few days ago, and damage to the amount of $20,000 was done. The office building and assembling rooms were almost totally destroyed and the foundry was damaged.

New Construction:—

The Belfont Iron Works Co., Belfont, O., is making extensive improvements to its plant.

Extensive improvements are soon to be made at the Exeter Machine Works, West Pittston, Pa. The shops now have plenty of work.

The Barnett & Record Co., Duluth, has been awarded a contract by the Duluth & Iron Range railroad for the re-construction of ore dock No. 3 at Two Harbors. The cost will be $300,000, with $50,000 additional for raising the railroad yard to correspond with the increased height of the dock.

Powers' Foundry, Elkton, Md., will increase its plant and erect pattern shops.

The remodeling of the old machine shop of the Pere Marquette at Muskegon, Mich., has been begun. When the work is completed the capacity of the plant will be increased one-third.

Charles P. Biggin & Co., Philadelphia, will build two additions to their ornamental iron plant, one building being 106 x 70 ft. and the other, 40 x 60 ft.

The Troy Laundry Machinery Co. has secured a new location for its Chicago plant. A building will be erected at a cost of $200,000.

The shops of the Southern railway in Princeton, Ind., are to be enlarged and improved within the next few months. The cost will be $35,000, not counting the new equipment. The shops at present employ about 250 men, but this force and the present buildings have been found inadequate.

The R. & C. Indicator Co., Bridgeport, Conn., recently incorporated, expects to build a plant for the manufacture of fluid tank indicators. The capital stock is $16,000.

George A. Glenn & Co., Philadelphia, are estimating on a foundry building for the Bridgman Bros. Co., 1426 Washington avenue, Philadelphia.

The Belmont Iron Co., Philadelphia, is rushing work on the erection of the structural material of the new buildings so that they may be completed as soon as practicable after the first of the new year.

The Champion Steel Range Co., Cleveland, O., will build a plant 208 x 85 ft., two stories. The plans were prepared by the Corlett Engineering Co.

The Home Stove Works, Chicago, were not seriously damaged by the recent fire. It is expected that a new building will be built, but the work on it will not be started until April.

The Brown-Corliss Engine Co., Corliss, Wis., has increased its capital, a portion of which is to be used for an extension of 60 feet to its present foundry and the remainder to be utilized as working capital to handle the large amount of business on hand and in view. The company now has something over $190,000 in business on its books, which shows that conditions are improved very materially.

The Portsmouth Steel Co., Portsmouth, O., expects to make improvements to its plant, but it has not been definitely determined just what will be done.

General Industrial Notes:—

The Missouri, Kansas & Texas R. R. shops at Smithville, Tex., which were shut down Nov. 23, have been reopened.

Directors of the Batavia Carriage Wheel Co., Batavia, N. Y., have decided to close the entire plant. This action was taken because of the continual loss due to the poor market for the product of the plant. The corporation was organized in 1887 and has a capital of $125,000. There is a main building 40 x 200 ft., two stories, with large sheds, storage warehouses and dry kilns. The stockholders will meet soon to authorize the sale of the machinery and the stock on hand.

The Wason Car Co., Brightwood, Mass., is building 38 cars for the government of the Argentine Republic. Manuel Florida, a representative of the government of that republic, has arrived at Brightwood and inspected the plans, which he has approved.

Morse Iron Works, Erie, Pa., have elected the following directors: Fred Koehler, C. M. Conrad, F. H. Payne, Thomas G. Morse, C. Kohlmiller, R. J. Salsman, E. S. Roach, Henry Herbst and J. Van Geem. The company has selected a site near the Buffalo road, between the Lake Shore and Nickel Plate railroads, which comprises about 20 acres and affords excellent railroad facilities.

T. W. Kneeland, Rochester, N. Y., manufacturer of the Fourdrinier cylinder paper machine, will locate his plant at Ravenna, O., setting up his equipment in the building formerly occupied by the American Foundry & Machine Co.

The bell plant and the good will of the Henry McShane Mfg. Co., Baltimore, have been purchased by W. M. Cary Jr. from the receivers for $20,000. Mr. Cary will continue to operate the plant.

The business of the Fairmount Machine Co., Philadelphia, Pa., has been purchased by the D. A. Tompkins Co., Charlotte, N. C., which will continue the manufacture of looms, textile machinery, power transmission machinery and elevators. The Tompkins Company is erecting a two-story building, 75x150 ft., to be equipped as a machine shop.

The board of public works of Milwaukee has awarded the contract for the 20,000,000 gallon pumping engine for the station at North Point to the Brown-Corliss Engine Co., Cor-

liss, Wis., whose bid was $64,500. The Allis-Chalmers Co. bid $65,000, the Filer & Stewell Co., $67,900 and the William Tod Co., of Youngstown, O., $68,000, $72,000 and $76,000. The specifications made no mention of the 8-hour clause, which was the means on former occasions of bringing the bids into court. The history of the pumping engine bids extends over a period dating from June 15.

Ole A. Arneson and Henry Kousek will establish a foundry at Kenosha, Wis., to be known as the Arneson & Kousek Foundry Co. A plant formerly used as a foundry has been leased.

The immediate business of the Upson Rotary Motor Co., Jacksonville, Fla., recently incorporated, will be to perfect the motor and improve it, after which further plans will be decided upon.

The Union Iron Works Co., manufacturers of engines, boilers, live rolls, logging cars and rebuilders of locomotives, Selma, Ala., has sold its plant to J. B. Ellis, C. W. Hooper, E. Lamor, Will Monk and others, who assumed control Dec. 1.

H. J. Harder has purchased the machine shop building formerly owned by H. E. Haas, at Beaver Dam, Wis., for $1,500, and opened a general machine shop. He will also manufacture gasoline engines. Mr. Haas has moved his works to Fon du Lac and will continue the manufacture of gasoline engines.

The United States Steel Products Export Co. has been awarded a contract for T-rails which are to be used in the construction of an extension to the Manila electric lines, Manila, P. I.

Charles E. Cherrington has purchased a large interest in the Colorado Iron & Wire Works, Pueblo, Col., and will assume the management of the business.

The John S. Stephenson Car Works Co., Elizabeth, N. J., which employs several hundred men, will probably pass into the control of a manufacturing concern engaged in another city in the same business. General Manager Kling states that negotiations are under way for the acquisition of the Stephenson plant by a company whose name he does not wish to make public.

The property of the defunct Toledo Co-operative Foundry Co., Toledo, O., worth about $900, will be sold for the benefit of the creditors.

The Marion Malleable Iron Co., Marion, O., recently incorporated with a capital of $40,000, will take over the plant and property of the old Marion Malleable Iron Co. The new company will take charge as soon as satisfactory arrangements can be made with the receiver of the old company, John A. Huber.

John H. Bass, car wheel manufacturer, of Fort Wayne, Ind., has sold all his stock in the Chicago Car Wheel & Foundry Co. to the Griffin Wheel Co., Chicago, for $300,000. Mr. Bass founded his Chicago branch in 1873 with a capital stock of $200,000.

The plant of the Lebanon Foundry Co., Lebanon, Pa., has passed into the hands of its new owner, J. R. Reise, of New York City. Negotiations had been under way for some time.

The American Axe & Tool Co., Glassport, Pa., which has been working three days a week for the past three months, has put its plant on full double term operations.

The 150-ton charcoal furnace of the Lake Superior Corporation, Sault Ste. Marie, Ont., is being prepared for operations and will go into blast at an early date. No. 1 stack, which is a 250-ton coke, is in successful operation, and is making about its capacity. The company's steel rail mill is making an average of 500 tons of rails daily and has recently received additional orders. The company has a protection of $12.75, which includes $7 duty, bounty on steel made in Canada, $2.25, and $3.50 additional bounty against dumping.

The plants of the American Clay Working Machinery Co., one located at Willoughby, O., and the other at Bucyrus, O., were sold Dec. 8 at receiver's sale to the bankers' reorganization committee, representing the creditors, for $350,000. The plants will be operated by a new company to be known as the American Clay Machinery Co. The new concern is capitalized at $500,000.

The Globe Foundry Co., recently organized at Port Chester, N. Y., with a capital of $10,000, will conduct a general foundry and jobbing business. The board of directors are: John F. Mills, John M. Heatherton, of Brooklyn, Herman L. Marshall, Thomas Fitzgerald and A. Sheldon Smith, of Brooklyn. The officers are: John F. Mills, president; John M. Heatherton, vice president; Herman L. Marshall, secretary and treasurer. The company has taken a lease of the old Bent foundry and will commence operations on or about the middle of January, at which time it is expected the plant will be fully equipped with new machinery.

An ingot weighing 90,000 lb. was cast a few days ago at the plant of the National Steel Foundry Co., New Haven, Conn. It was one of 13 ingots which the company is making for the Fore River Ship & Engine Co., Quincy, Mass., and is destined to be one section of the shafting for some of the twin-screw battleships now under construction at that plant.

The Berkeley Springs Shovel & Tool Co., Berkeley Springs, W. Va., has disposed of all of its property, both real and personal. The machinery was purchased by a firm in Canada and when loaded will be shipped to Canada. The real estate, including the factory building, was sold to the West Virgnia Sand Co.

The Jackson Tin Plate Co.'s plant, Clarksburg, W. Va., has been sold for $62,500 to the bondholders. The plant cost twice as much two years ago.

At a meeting of the executive committee of the Sloss-Sheffield Steel & Iron Co., Dec. 9, the regular quarterly dividend of 1¾ percent was recommended.

The Ellis Foundry, South Carver, Mass., has closed its doors. The plant has been engaged in the manufacture of hollow iron ware at the site of the first iron making industry in that part of Massachusetts, if not in New England.

At the locomotive and construction departments of the Panhandle shops, Logansport, Ind., the time of work has been increased from eight hours for five days to nine hours for six days in a week.

The foundry of the Geiser Co.'s plant, Greencastle, Pa., will be ready for use in about a month.

The Atlas Safe Co., Fostoria, O., which recently sold the machinery, patterns and stock of its safe department to the Wehrle Co., of Newark, O., will continue the operation of its other departments, including light iron and brass castings, nickel plating and general repairing.

The Cleveland-Cliffs Iron Co. is making rather extensive repairs to its plant at Gladstone, Mich. The plant went out of blast some months ago as a result of an agreement reached to curtail pig iron production until the demand should pick up. A few months ago the chemical plant connected with the furnace was destroyed and it has been rumored that the plant might be moved to Munising, but the improvement of the furnace indicates that the company does not expect to move. It is understood that the chemical plant will soon be rebuilt.

In the United States district court at Wilmington, Del., the receivers of the Diamond State Steel Co., Howard T. Wallace and James P. Winchester, were discharged. The court gave notice that ten days later bankruptcy proceedings against the company would be dismissed.

It was announced in New York last week that the United States Steel Corporation had declined the invitation of foreign steel rail manufacturers to join the international rail pool.

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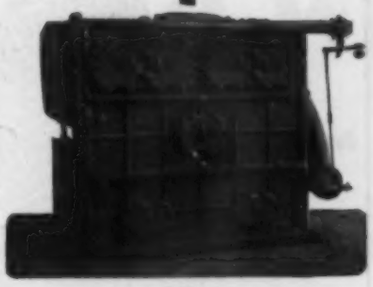

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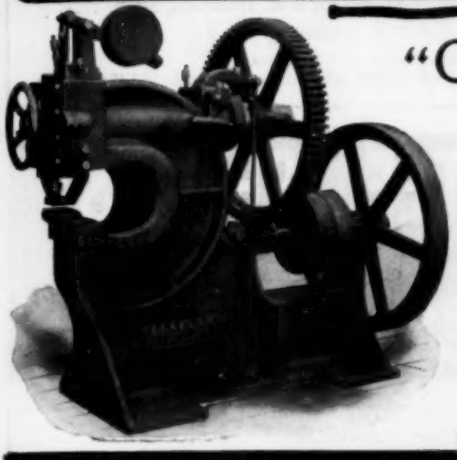

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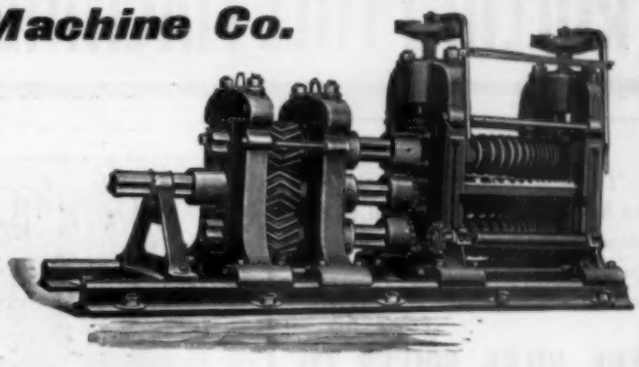

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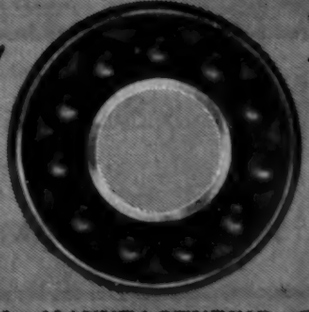

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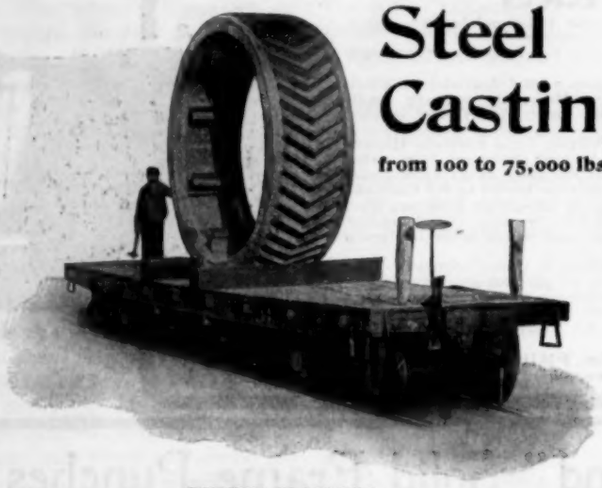

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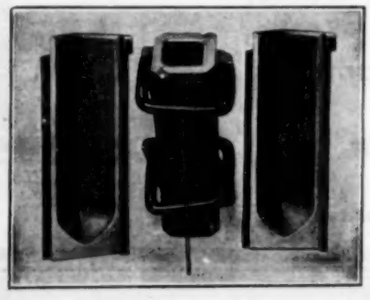

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